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IMPROVED BRIDGE CONSTRUCTION.

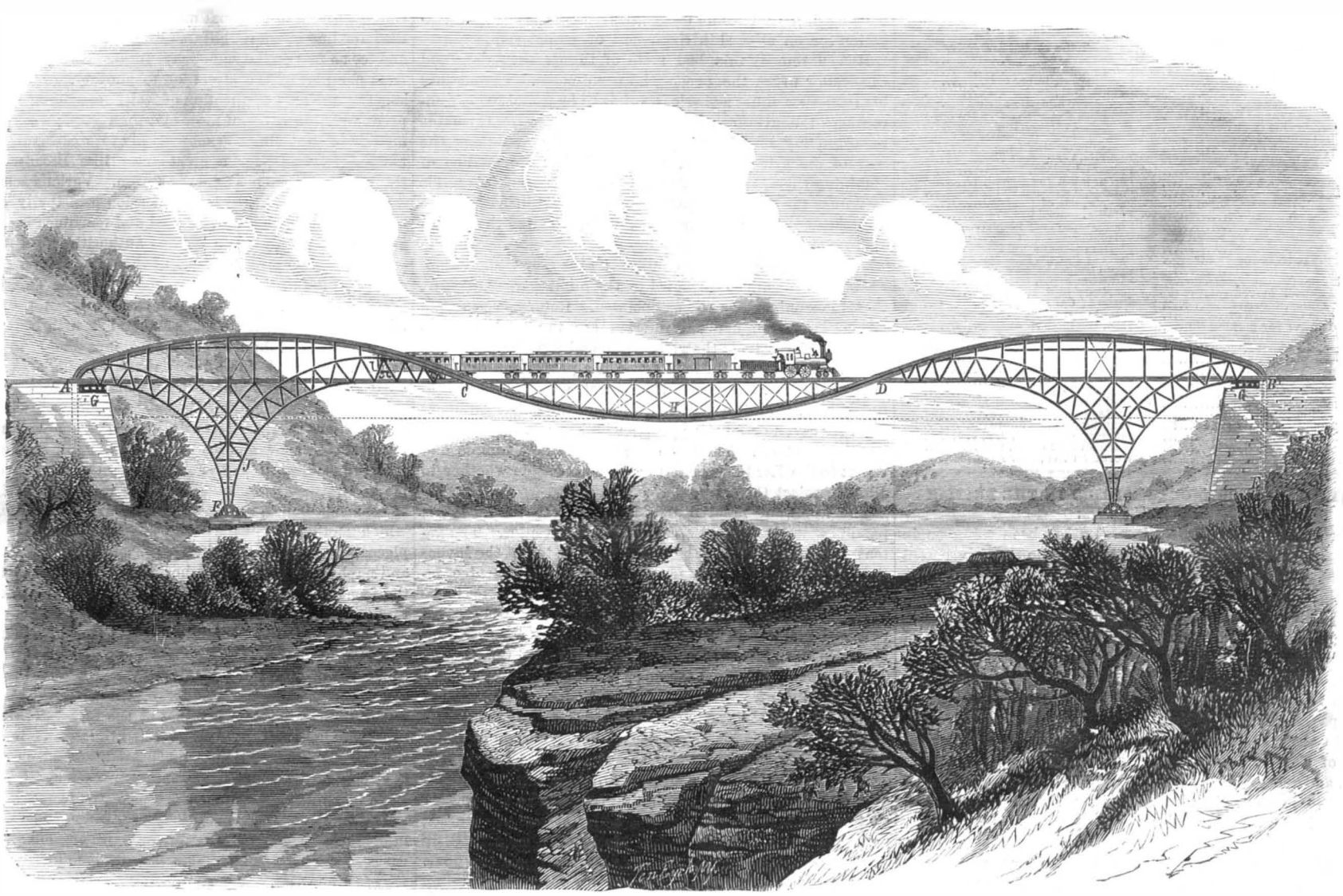
The accompanying engravings illustrate improvements in the construction of bridges of long spans, on the cantilever and suspension principle combined, which was patented to J. D. Pierce on August 5, 1873.

The whole bridge, from A to B, Fig. 1, is composed of the middle truss, C D, of 316 feet, and of the two end or side trusses, A C and B D, each 296 feet long, in all 908 feet. The arches under and sustaining the side trusses constitute triangular, quadrangular, or lenticular type, a saving of nearly 50 per cent is found in favor of the present system. With very long spans, it is claimed that the percentage of saving will be even greater. Besides, the fact of avoiding piers in navigable rivers is of considerable importance. Captain J. B. Eads tells us, in his report of June, 1868, to the directory of the Illinois and St. Louis Bridge Company, that it is idle to talk about putting piers in a river without some obstruction to navigation, whatsoever the span.

pose or inertia is claimed to be enormous, while there is little appearance of top heaviness.

High ratio of cost in long spans is avoided, in the system here advocated, by the crossing of the chords at C and D, cutting one truss, as it were, into loops of three, reducing the depth of trussing, and giving support to all by keystoning from underneath by tension, in place of above or overhead by compression.

The dotted line, I I, Fig. 1, shows how a second grade line



PIERCE'S IMPROVED METHOD OF CONSTRUCTING BRIDGES WITH LONG SPANS.

the bottom or compression chords. The clear span between foot of arches is 680 feet. The curved line, A C D B, is a chain which is under constant tension, and which extends to an anchorage at each end, at E. The arches are hinged at E and F, and the ends of the bridge sit on curved beds of rollers at G. The chords, F D, are cut at the intersections, C and D, and joints are there placed, also to serve as hinges. Within these four hinges the structure is free to move according to thermal demands, and hence to maintain its rigidity.

Fig. 2 shows how this system repeats in spans when one is not enough to cross over the river. S T shows the grade line, P and Q anchorage of the curved tension members in their opposite arches, and R, a pier on which the spans compound one half their respective weights.

Regarding the comparative merits of this system, the inventor refers to data furnished by Mr. J. C. Trautwine, C. E., in his work on the subject. The table of weights of trusses there given, and the formula also for calculating others, has been compared with those weights of trusses as laid down in Mr. John A. Roebling's work on "Short and Long Span Bridges" and other authorities, and found to hold good approximately.

The middle truss of 316 feet, at 1·23 tuns per lineal foot, weighs 388·6 tuns. The other two, though a little shorter, have a weight double that of the middle truss; this sum includes the arches under them and on which they lie.

The whole bridge, track included, would weigh about 1,943·4 tuns, and the total cost is estimated at $372,757.00.

The greatest strain that comes on this bridge of 680 feet span, the inventor calculates, is less than that of a truss of 450 feet span of like requirements. Comparing the cost with other systems of rigid character, and supposing that it be desired to cross the same river, with one center truss of 680 feet and two side spans of 114 feet each, all of the usual

The anchorage is the first work begun in carrying the plan into practice. The end trusses, resting on arches, are next built out, self-sustaining. On their completion, a chrome steel chain or wire cable is drawn over the opening space. This furnishes support for putting in the middle truss. The cables first act as overhead false works; but after filling this function, when the bridge is completed, they remain as one of the supports of the middle truss, and in fact of the whole bridge, and are counted as integral members of the same.

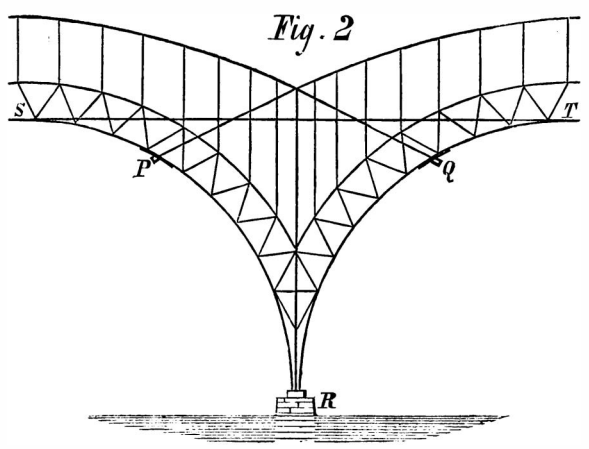


Fig. 2

They are shown at H, Fig. 1. By their amount of power, the curved chord (webbed to the straight ones) is relieved in strain and amount of material.

It should be observed that the structure presents a small area of surface to storms compared with others of like length of span. Anchored to the earth at each end, and with a large portion below the center of gravity as well as above, its re-

may be suspended from the trussing above, and through that below, the straight chords.

The arches are made ribbed to provide stiffness under passing trains, but the amount of material is but little increased thereby.

No high claim is made for this system when all is free to have piers low and ever so often; but where deep waters are to be crossed, and it is desirable not to interfere with navigation, then it is this plan commends itself. To places like Lewiston, N. Y., this plan is claimed to be especially suitable; as instead of a great truss 60 feet high and 600 long, as lately proposed, a depth of trussing of about 25 feet would answer. The system can also be much varied to suit localities, thus offering an interesting field for skill in designing and æsthetic treatment.

For further particulars address J. D. Pierce, Arrington, Nelson county, Va.

Mind and Health.

The mental condition has far more influence upon the bodily health than is generally supposed. It is no doubt true that ailments of the body cause depressing and morbid conditions of the mind; but it is no less true that sorrowful and disagreeable emotions produce disease in persons who, uninfluenced by them, would be in sound health; or if disease is not produced, the functions are disordered. Not even physicians always consider the importance of this fact. Agreeable emotions set in motion nervous currents, which stimulate blood, brain, and every part of the system into healthful activity; while grief, disappointment of feeling, and brooding over present sorrows or past mistakes, depress all the vital forces. To be physically well one must, in general, be happy. The reverse is not always true; one may be happy and cheerful, and yet be a constant sufferer in body. —*Brooklyn Journal of Education.*

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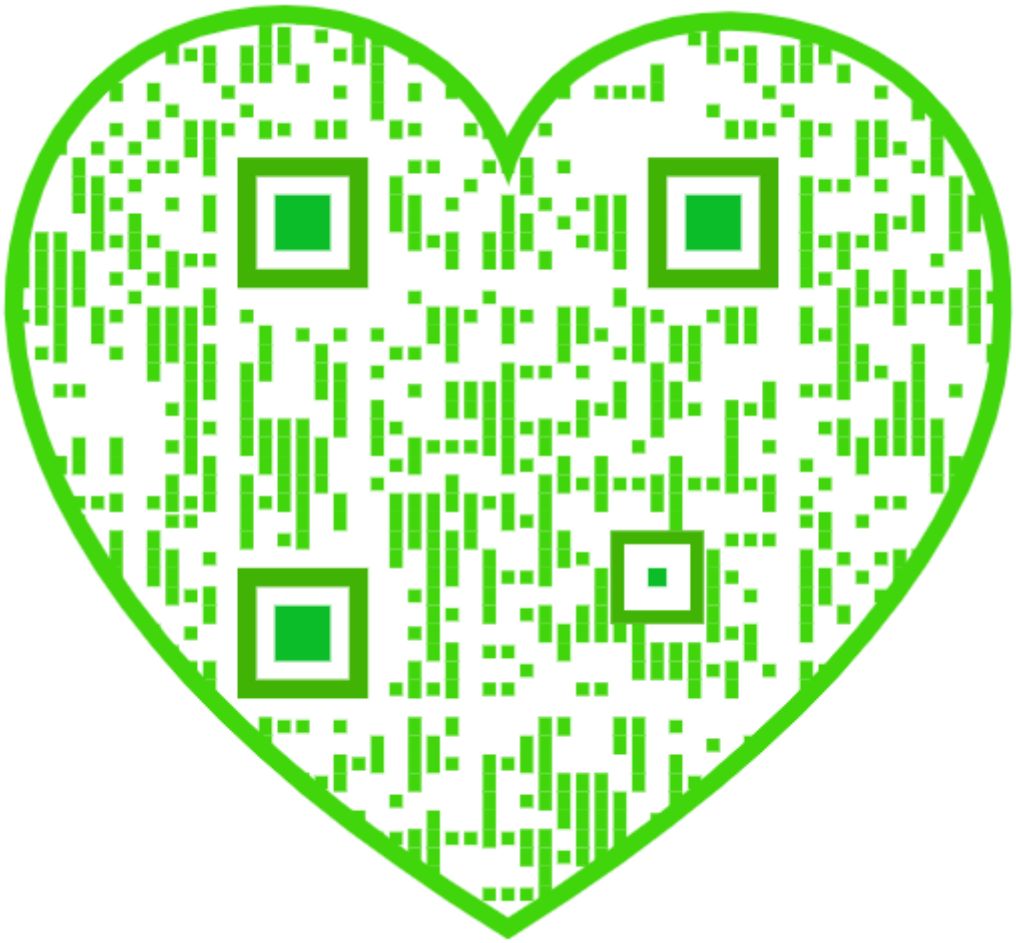

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IMPORTANT CHANGES PROPOSED IN THE BRITISH PATENT LAWS.

For several years past a discussion has been going on in England touching the amendment of the British patent laws. A Parliamentary Committee have examined witnesses; the press, the patent solicitors, the Society of Arts, and many experts have assisted in the discussion. The testimony has been carefully sifted, and a very large amount of ability has been brought to the consideration of the subject. The result of these labors has crystallized in the form of a Patent Law Reform Bill, lately introduced in Parliament, and passed without serious opposition through committee. Lord Cairns, the Lord Chancellor of Great Britain, the great gun of England, was the introducer and advocate of the bill, and opened the subject by the delivery of an oratorical broadside, two or three hours in length, the report whereof, n small type, nearly fills one of the large pages of the London *Times* yclept the *Thunderer*.

His Lordship gives some striking statistics concerning English patents, illustrates the prolific and, in some instances, amusing operation of the American system, and strenuously urges the necessity of the proposed amendments, which have for their object to suppress or check the granting of patents for inventions.

The existing patent law of England provides, in brief, as follows: Patents are granted to the first applicant, whether inventor or merely introducer. No official examination is made; but all patents are printed and accessible, thus enabling applicants to make their own examinations. The patentee enjoys the exclusive possession of his patent. No one may use it without his consent. He is not compelled to work it within any specific period. If the thing patented proves to be lacking in novelty or utility, the patent is good for nothing.

These provisions are admirable for their simplicity and practical excellence; but their beneficent capabilities are marred, and indeed almost suppressed, by the heavy payments demanded by the government for issuing and certifying the patent. The duration of the patent is 14 years, divided into paid periods of 6 months, 3 years, 3½ years, and 7 years. If the official fees attached to each period are not paid up, the patent terminates on the day of failure. The total official fees now charged are £175 sterling, or $875, for a British patent of 14 years. The British patent extends over England, Wales, Scotland, Ireland, and the Channel Islands.,

For the British colonies, some twenty separate patents are required, the average government charge for which is $200 each; making, with the home patent, a total of $5,000, as the government demand for a patent privilege of 14 years, for the States of Great Britain. We believe there is no other nation that imposes such heavy charges upon the inventive portion of its people, nor is there any patent-granting nation that, considering the ratio of population, issues so few patents as Great Britain.

But it appears that a further curtailment has become necessary. The Lord Chancellor, in his great speech, tells us that 4,300 patents are annually applied for in England, of which one third are abandoned at the end of the first six months, and become null, by reason of the non-payment of the sealing fees, amounting to $125. Seventy per cent of the remainder become null at the end of the third year, by non-payment of the tax of $250. Twenty per cent of the surviving patents terminate at the end of the seventh year by non-payment of $500 then due, leaving less than 700 patents per annum that actually run for 14 years; while the average total life of English patents, as deduced from the Lord Chancellor's statements, provisional patents included, is only a little more than *four years*.

To Americans, who are accustomed to the grant of thirteen thousand patents every year, each for the full term of seventeen years, the diminutive issues of Great Britain seem like a trifling affair. But to the mind of the Lord Chancellor an English patent is a big thing.

"You have granted in this country every year," he says, "the enormous number of patents I have mentioned, and what is the effect on the industry of the country? The manufacturer, in carrying on his regular course of trade, is hampered by owners of worthless patents." "I cannot imagine anything more serious to all the manufacturers of the country than that 4,300 drag nets, more or less, should be spread, every one of them curtailing, to some extent, the area of those manufactures, and every one of them exposing manufacturers to litigation, or perhaps to the payment of blackmail, if they would escape the irksome process of litigation for an alleged infringement of patent rights."

It is to remedy this bad state of things that the Lord Chancellor urges the proposed amendments. Throughout his long speech not a single word is to be found which encourages the inventor or recognizes his title to the favorable regard of my lords' countrymen. Instead of reducing the cost of procuring patents, and simplifying the method of obtaining them, the sole aim of the Lord Chancellor's bill is to reduce the number of patents granted by increasing the difficulties of their procurement, and subjecting the inventor to new and vexatious requirements.

The new bill provides as follows: Five new Commissioners of Patents are to be added to the number now in office. Certain examiners are to be appointed. Referees are also to be chosen. Examiners and referees are to consider all applications for patents that are made, and report to the Commissioners whether the application is a proper subject for a patent, whether the papers are correct, whether the invention is new, what it consists of, whether the patent ought to issue for seven or fourteen years, whether a patent ought to be granted at all. The law officers will then examine and report to the Lord Chancellor, who is to decide whether to allow or reject the case.

The applicant must declare himself to be the inventor; patents will not be granted except to the inventor. The patent may be revoked if the inventor fails to put the invention in operation within two years, or if the patentee refuses to grant licenses to persons who ask, on terms to be fixed by the Lord Chancellor. Government may use any patent, and make such payment as the Treasury chooses to allow. No appeals from the decisions of the Lord Chancellor. The fees remain about the same as at present.

The plain inference from the Lord Chancellor's expressions, and from the amendment he presents, is that England has no further use for the services of ingenious and originating men. Her manufacturers complain of them, and petition to have their patents suppressed. Men like Arkwright, a barber, the author of the spinning frame, who was so poor that he had to shave people in a cellar at a penny a head; men like Cartwright who, with his loom, almost built up Manchester; men like Watt, the poor instrument vender, whose steam engines furnish power for these complaining manufacturers; men like Stephenson, the poor stoker, and son of a stoker, who gave railways to Britain—the time has come, it appears, when men of this kind are not to expect further encouragement under British patent laws.

We do not propose to reason with the Lord Chancellor and his coadjutors upon the folly of such legislation. But we want their constituents to know that the American people regard the inventors of England as their benefactors, deserving of encouragement and honor. They cherish with deep reverence the memories of the long line of worthy Englishmen, humble, it is true, in family origin, who by their discoveries and inventions have filled the earth with new methods and appliances of industry, and given supremacy to their native land.

We are doing all that we can, as a nation, to encourage and stimulate original inventions in our midst. It is by industry and intelligence that we thrive. We therefore extend the hand of greeting to inventors of every clime. We say to them: Come hither with your new arts. They help to enrich us; they add to our national strength; they increase our moral power. Especially do we welcome inventors from the people of Great Britain, to whom we are allied by many ties. We speak their tongue, they are our kindred; from them our laws, our national existence, have sprung.

We acknowledge our indebtedness to the Lord Chancellor for spreading among his countrymen the intelligence that while it has become necessary to restrict and burden English inventors, they will find no burdens or restrictions in the United States. Here they will encounter few complaints against patents by manufacturers. The principal wail to be heard in this country is the cry of the manufacturer, asking inventors to study out new and practical things with which to occupy and task his machinery.

The Lord Chancellor will add to our obligations if he will again kindly announce in Parliament, and circulate the news widely in the British realm, that all Englishmen, although denied at home, may freely obtain patents in the United States for the smallest inventions, provided they are new and useful; that patents are granted here for 17 years for the small sum of £7 sterling; that the patent covers the thirty-eight State and nine Territorial governments of the American Union; that an English patentee possesses here the exclusive control of his invention during the term of the patent; that he is not obliged to work his invention, or pay any taxes or annuities in order to preserve the life of his patent; that neither Government nor private individual can interfere, or use his patent without first obtaining his consent on his own terms.

In short, let it be everywhere made known that the government of the United States aims to encourage inventors and authors, by securing to them an absolute property in their inventions, whether great or small, for the term agreed upon in the patent. This is the one distinctive characteristic of the American patent law. It is this which gives value to our patents; and it is because they are valuable that so large a number are annually solicited.

A NEW MACHINE FOR REMOVING SNOW FROM STREETS.

The exceptionally severe season just gone by, with its heavy snowfalls and deep frosts, the remains of which have far from disappeared even yet in more northerly localities, has brought home, to the business community especially, the great need of artificial means for effectually preventing the impeding of thoroughfares by the rapid removal of snow and ice as fast as the same may form. Sweeping the snow from one part of the street on to another, or melting the same by the free application of salt, are common remedies, productive, however, of more evil than good; while the slow method of shoveling the snow bodily into carts, and thus removing it, costs, for a great street like Broadway, something like $20,000 per mile per season. Various schemes for melting the deposit, by the application principally of superheated steam, have been proposed, and machines for that end devised and submitted to our city authorities; but up to the present time no practical tests of the proposed means, so far as we can learn, have yet demonstrated their suitability to the end in view. The street railway companies drive jets of steam down on their tracks and follow with heavy revolving brushes, but the heat in this instance merely loosens the frozen mass, which the brushes throw to one side to aid in obstructing the balance of the roadway.

With this state of affairs in existence, it was with much gratification that we recently examined a novel invention for removing snow and ice by the direct application of an intensely hot blast of flame generated by the familiar and simple apparatus of the blowpipe. The machine consists of a small steam boiler, upright and cylindrical in form, beside which another receptacle of like shape to contain naphtha is placed. The same fire serves to generate steam in one boiler and naphtha vapor in the other, and the whole is located on the front portion of a low wagon, the body of which is of iron and has a water bottom to protect the parts above from, as well as to confine, the intense heat beneath. Extending downward from the vapor chamber are one or two rows of tubes, the openings of which are in line across the bottom of the vehicle. A like number of pipes from the steam generator discharge steam jets just at the orifices of the vapor tubes; so that, the vapor being ignited, the steam mingles with the flame, becomes highly superheated, and also draws in a a strong current of air to the same, through apertures in the large jacket tube which encloses each pair of pipes.

The mouth of each tube, therefore, when the machine is in operation, emits a steady stream of flame, hot enough, as we saw, to heat clay and stone beneath it to a bright red in a very few minutes, and certainly sufficiently powerful to demolish several inches of ice or snow by merely passing over. In fact the space beneath the apparatus, at the orifices of the tubes, looked like the interior of a furnace under a strong draft; and this heat, as the wagon advances, is carried under the same and confined by the body above and flexible runners, reaching to the ground on the sides, front, and rear. The mere force of the escaping blasts is sufficient to make cavities of some little depth in hard ground, when the machine is standing still, and to scatter ice and snow so thoroughly as to allow such as escapes complete melting to be easily swept away. It will be observed that the main objection to a steam blast, superheated or otherwise, namely condensation, is here absent, and that the heated gases are not merely applied to the surface of the mass, but driven directly into its very substance.

The inventor, Mr. C. G. Waterbury of this city, has made the subject an especial study for some years past; and judging from the favorable notice which his device is already receiving from city officials and others, there is a fair probability of its adoption, and some prospect of our streets being kept clear during next winter. It is proposed to put six machines at work on Broadway at the beginning of every snow storm, and let them melt the snow as it falls. A few men with brooms could quickly drive the water produced off toward the sewers, and thus that banking and caking of the snow which so effectually blocks the streets to traffic would be obviated

PROGRESS OF RAPID TRANSIT IN NEW YORK.

The movement to secure the completion of a rapid transit railway through this city is beginning to take practical shape, and it will not probably be long ere the matter is brought to a successful conclusion. It is conceded on all sides that the principal obstacle in the way is the depressed financial condition of the country. Those who own first class real estate, in our midst, have for a long time been unable to sell or realize money thereon, except in ruinously small amounts

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and it is therefore not surprising that even the best of our rapid transit schemes should languish for want of funds. Some of our enterprising citizens, who know this but are determined that Rapid Transit shall no longer rest, have formed an association to promote the matter financially, by raising a fund of three millions of dollars, to be applied in carrying out whatever plan the subscribers to the fund may decide to be best, after the money is raised. They have ascertained by experience that, if plans are to be first discussed, there will be no end to the discussion, and no time left to obtain subscriptions. They have therefore decided to raise the money first, and talk afterwards, which is assuredly a very practical method of procedure.

At a recent meeting of the association, a board of directors was nominated, consisting of eminent and reliable citizens, in whom the public have great confidence. Progress of subscriptions was also reported, when it appeared that three hundred thousand dollars, or ten per cent of the whole amount, had been already pledged. This is certainly very encouraging.

The speakers reminded those present that a splendid line of rapid transit railway, half way through the city, was almost completed, and would be put in operation within a few days, namely, the Harlem Underground, and that it only needed the continuation of the same tracks down to the Battery to furnish New York with a better system of local communication than that of any other city in the world. It was suggested that, while it was out of place for the Association to discuss particular plans, still the members and others who were interested might do well to examine the works above mentioned, where all the various forms of railway that are being advocated, the Elevated, the Open Cut, and the Underground, may be examined and compared, and their effects upon the value of adjoining property, and their relative interference with the public uses of the streets, studied to the best advantage.

It was suggested that the great viaduct between 98th and 116th streets was perhaps as fine an example of the Elevated, or high level railway, as could be built, although it filled up the street, and the adjoining property would be found to be less in value than elsewhere on the line. The depressed or Open-Cut railway could be seen to the best advantage where it passes through the main street of Harlem, from 116th street to 133d street. It would be found that this plan, while it was less objectionable than the elevated, still occupied and absorbed the best portion of the avenue, and was disadvantageous to the adjacent property. The Underground railway could be studied between 56th street and 96th street, and here, above the railway, would be found a broad and magnificent avenue, beautifully paved and regulated, of park-like appearance, especially desirable whether for business or residence, and here the adjoining property would be found to be higher in value than at any other point along the line.

The remarkable conjunction of all these different methods of city railway construction upon the same street, all the examples being of equal capacity for traffic, certainly affords to our citizens the best possible opportunity for correctly deciding which of the methods is the best for construction down through the business and crowded parts of the city.

The recent construction of these different styles of railway also places before our citizens positive evidence of the actual cost of building on either plan. In this respect the construction accounts will, we think, show that there is little to choose in the matter of economy between either of the forms. If there is any difference, the high level road will be found to cost probably more than the low level railway, capacity of traffic being equal.

We recently gave an engraving of the shaft of the Hudson river railway tunnel, which has been commenced on the Jersey City side of the Hudson, designed to lead the tracks of the great railways, which there center, directly into the southern part of New York by the underground method, the same as is now done at the northern part.

The city of New York will undoubtedly require ere long several independent lines of rapid transit railways, but what particular forms of construction should be employed, whether they should all be alike or different, it is perhaps too early now to determine. The general conclusion reached by the Rapid Transit (Elevated) Railway Committee of the Civil Engineers' Society is that each main line must have a traffic capacity at least equal to the London Underground Railways. In this conclusion everybody will agree. The standard for passenger accommodation is that afforded by the Underground. Nothing less will satisfy the public. The suggestion naturally follows: "Why not, for a first main line, complete the work so nobly begun, by carrying the Underground road down town at once?" The indications are that this will be done. We have only to add 4½ miles to the work already built, when we shall have in operation a safe, capacious, and fast railway underground from the Battery to Harlem river, a distance of nine miles.

Several excellent charters for fast railways in New York have been granted, and a bill is pending before the State legislature for a general law empowering the formation of other companies. So we are not likely to lack for franchises. But the tendency of this multiplication of charters is to hinder rather than to promote rapid transit. The immediate question for builders will be: Which, on the whole, is the best route for business? Which line will be the most sure to return a reasonable interest on the large expense which the work inevitably involves? The eminent British railway engineer, Mr. John Fowler, affirms that local or city railways, in order to ensure to themselves the largest amount of permanent traffic, must be located directly on the lines of greatest local travel, where they constantly command the public attention. In this view, the Broadway line would seem to have pre-eminent advantages. No other street in the world is so constantly crowded with travel. The gradual changes which are going on along this thoroughfare, by the erection of gigantic buildings, point to a day, not far distant, when its local population alone will suffice for a generous support of a railway placed under its pavement; and that if all the side avenues had their rapid transit rails, the Broadway line would never suffer for lack of business.

AMALGAMS FOR FILLING THE TEETH.

An article under this heading, published in our paper of January 3, and referring to observations on the subject made by Dr. Clowes, of this city, before the Odontological Society, has called out a number of communications from members of the profession. We regret that our limited space prevents their publication. Dr. A. C. Castle, M.D., of this city, one of our oldest practitioners and a well known scientist, sends us an excellent article on the subject. Probably no one in the profession has had greater experience than he in the matter. He, by the way, calls our attention to a misnomer in our article, where we spoke of the use, by Dr. Clowes, of tin amalgam. We should have said dental amalgam, as every intelligent reader doubtless understood. It was the usual dental amalgam or compound, containing tin and silver, with sometimes other ingredients, that we referred to.

Dr. Castle tells us that he has been in the full practice of medico-dental surgery in this city for the last forty years, and during all that time has been constantly using amalgam fillings for badly decayed teeth. He gives us an interesting account of the early battles that took place a generation ago among the dentists. Dental amalgam was introduced in this city by his father, in 1829. In 1846, the late Dr. Eleazer Parmly, an eminent dental practitioner, began hostilities against the filling, on the score of injury to health, etc.; but when challenged to produce proofs, he utterly failed. On the other hand, Dr. Castle brought forward the most indisputable evidence, medical, metallurgical, and professional, fully sustaining the utility of the amalgam. From that time to the present, Dr. Castle tells us, its popularity and use, to apply a strong figure of speech, has advanced, almost, as it were, by a geometrical progression. To Dr. A. C. Castle, and primarily to his father, the profession is indebted for the introduction, improvement, and practical exemplification of this highly useful agent.

Dental amalgams, says Dr. Castle, can only be formed under certain conditions. Platina, unless melted with and combined with silver, will not form an amalgam. Tin will mix with mercury, but it will not crystalize or harden without a large addition of silver. So it is with gold and other metals. Silver is absolutely necessary to make hard amalgams for the teeth. But silver is affected by gastric acids and gases, which discolor dental amalgams, and, in many mouths, even the purest gold. In the shape of an amalgam, the quicksilver modifies the character of silver, rendering it less liable to the action of the gastric acids, and as durable in the teeth as the other metals or fillings used for this purpose.

TEST OF AMERICAN IRON AND STEEL.

The Sundry Civil Appropriation Bill, passed among the last acts of the late Congress, contained an appropriation of $75,000 for tests of iron and steel, to be made by a board of engineers, who were to serve without pay, with the exception of the secretary. The members of the board have recently been appointed by the Secretary of War, as follows: Colonel T. T. S. Laidley, Ordnance Department, U. S. A., resident; Professor R. H. Thurston, Secretary; Commander L. A. Beardslee, U. S. N.: General Q. A. Gillmore, Engineer Department, U. S. A.; Chief Engineer David Smith, U. S. N.; W. Lovy Smith, C. E.; A. L. Holley, C. E. A testing machine is to be built, and set up at the Watertown Arsenal, where the experiments are to be conducted. The board will receive instructions from, and report to, the Chief of the Ordnance Department of the Army.

The members of this board are all well known engineers, several of whom have already distinguished themselves by their investigations of the properties of materials used in construction. It would be difficult to over-estimate the value of their future experiments, if carefully conducted. To mention a single instance, it may be stated that the English formula deduced from Gordon's experiments is almost the only authority available to our engineers for computing the resistance of materials to compressive strains. Very few of our engineers could afford to make such experiments as they desired; and when such investigations were conducted by companies, the results were not usually available for general use. It seems probable, therefore, that the appropriation, made by Congress for these experiments, will be productive of more good than many other items for which ten times the amount was allotted

ANOTHER EARTHQUAKE INDICATOR.

In a late number of the SCIENTIFIC AMERICAN we gave an illustrated description of the earthquake indicator of Count Malvaria, of Bologna, Italy. A much simpler device has been for some time in use at the Cambridge Observatory, Mass. This was adopted by Professor Winlock, the distinguished astronomer, the Director of the American Nautical Almanac, and it is an excellent illustration, taken with the first described instrument, of the comparative simplicity of Yankee devices, and the directness with which American ingenuity attains its object.

The great equatorial at the Observatory of Harvard College is mounted upon a massive granite pier, whose foundations extend far below the surface of the ground. The floors of the building are carefully kept out of contact with this pier, in order that no tremor may be communicated to the telescope by the structure. This pier can therefore only be moved by actual motion of the earth. Four little pins, slightly conical in form, are balanced, small end down and large end up, on the upper face of the pier. They are so nicely pointed that it requires some skill and care to set them up. Once set up, only movements of the earth will throw them down. When thrown down, the direction in which they lie indicates the direction of the earthquake wave. At the time of the shake which so seriously disturbed our neighbors of Westchester county, one of these pins was found overthrown, indicating that the shake probably affected slightly the Hub of the Universe.

We presume that many of our readers will adopt the Cambridge earthquake indicator, and that we shall learn from them the direction of movement and the extent of the next earthquake. This little device is far simpler and, we think, more accurate and reliable than that of the Italian Count.

KAOLIN IN THE UNITED STATES.

A letter appears in our correspondence columns, signed by Mr. S. D. Morgan, of Nashville, Tenn., in which the writer takes the ground that we labor under a mistake in stating that kaolin suitable for fine porcelain is not produced within the United States. Our statement was based on the assertion of one of the oldest, as well as one of the largest, consumers of the clay in the country, and that gentleman assures us that, though he would be highly gratified if he could substitute an American for a foreign raw material in his manufactures, and that he had endeavored to awaken interest in the discovery of suitable kaolin beds, as yet his wishes and efforts have been entirely futile. We are well aware that there is an abundance of kaolin deposits open; but we have yet to learn of one in which the material is sufficiently free from iron and other impurities to serve the purpose of manufacturing the fine grade of porcelain, to the description of which our recent article was devoted.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW POISONOUS SNAKE.

A wonderful poisonous snake has just found a home in the London Zoological Gardens. This is a snake-eating snake, hence called *ophiophagus*. Dr. Fayrer has ably described this creature. We learn from him that this most formidable of poisonous snakes is found, but not commonly, in India, the Andaman and Philippine Islands, etc. It is the largest and most formidable of known venomous snakes. Shortly after his arrival he was fed by the keeper, who put an ordinary English snake into his cage; the *ophiophagus* quickly devoured the English snake by bolting him head first. In general appearance this new snake is very like a common cobra, except that, when he spreads his hood, he is seen to be marked in very pretty bands, not unlike the patterns on oil cloth. The head is somewhat almond-shaped, exceedingly lizard-like, not flat and triangular like that of the rattlesnake. When sitting up with his hood expanded, the snake is continually jerking his head in a restless manner, reminding us of the quick, darting action of the common green lizard; the eye is exceedingly clear and bright. When disturbed he hisses loudly, and shows his temper by extruding his long, black, forked tongue, which he vibrates with marvelous celerity. The lower part of the glass of the cage now inhabited by this snake has been painted white, in order that his naturally hasty temper shall be disturbed as little as possible by the morning calls of visitors.

PRAIRIE CHICKENS AND GRASSHOPPERS.

While naturalists and entomologists are puzzling over the discovery of some plan to prevent the recurrence of the grasshopper plague in the Western States during next fall, it would be well for them to take the immense yearly slaughter of the prairie chickens into consideration. The numbers of these birds which are slaughtered each winter by trapping after heavy snow storms, and find their way to the markets, are something enormous; and as the grasshoppers constitute a great part of their natural food, it seems not improbable that the disappearance of the former might exercise a very appreciable effect in the increase of the devastating insects.

ANILINE INKS.

The majority of aniline colors soluble in water furnish inks of excellent quality. Dingler's *Polytechnische Journal* of recent date gives the following practical recipes for their preparation, by which any one can make the fluids very easily: Violet ink is obtained by dissolving one part of aniline violet blue in 300 parts of water. This ink is quite limpid, dries quickly, and gives a remarkably dark color. It is necessary that new pens should be employed in using it, as the smallest quantity of ordinary ink mixed with it causes its alteration. Blue ink is made by dissolving one part of soluble Paris blue in 250 parts of boiling water; red ink, by dissolving one part of soluble fuchsin in 200 parts of boiling water. While ordinary inks are decomposed by numerous substances, and notably by hydrochloric acid, aniline inks are completely ineffaceable from the paper on which they are used. They resist the action of acids and even of chlorine.

EBULLITION OF SULPHURIC ACID.

According to M. Bobierre, sulphuric acid may be caused to undergo regular ebullition by the addition of thin plates of platinum in the proportion of 180 grains of metal to 32 quarts of acid. The whole is to be treated in a vessel of 55 quarts capacity.

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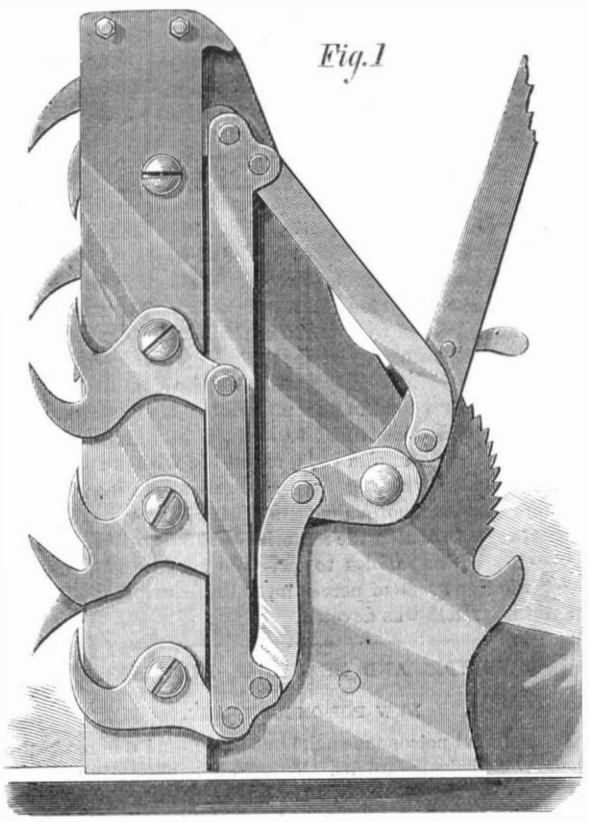
BECKWITH'S IMPROVED LUMBER DOG.

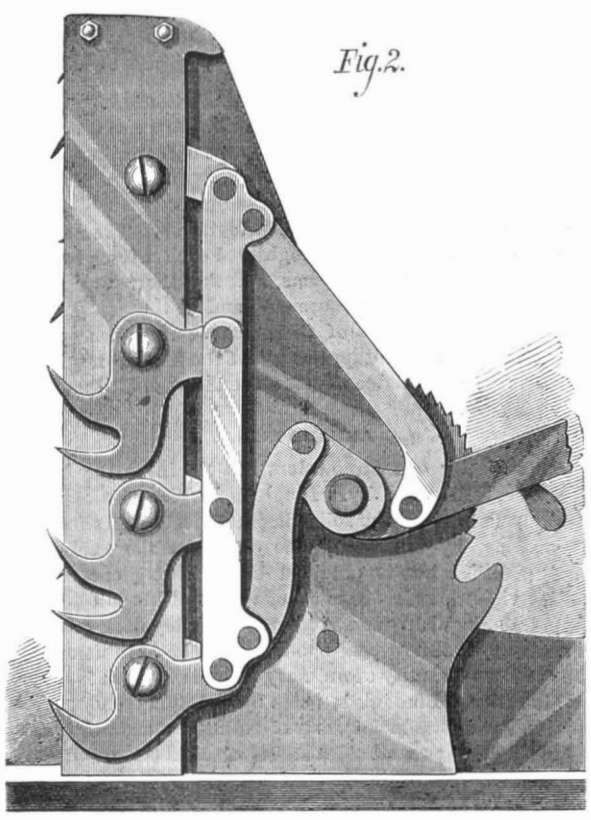
The annexed illustrations represent an improved form of lumber dog, the advantages of which are plainly set forth, and will be appreciated by those engaged in working lumber. The lever, when drawn up as shown in Fig. 1, and secured by the ratchet, thrusts two sets of teeth into the log, one pointing upwards and the other down. This arrangement is claimed to be the only one by which timber of any shape, square, round, or irregular, can be firmly seized, held, and drawn to the standard; and this advantage is secured by a very slight exertion of manual power on the lever. In Fig. 2, the device is shown with the lever down and the

Fig. 1



teeth in the normal position. These dogs may be attached to any ordinary standard. They are made of steel almost entirely. The pivots on which the teeth vibrate are solid with the bed plate, and are of cast steel one inch and an eighth in diameter. The ratchet and pawl on the lever prevent any possibility of the dogs letting go the log, and the double teeth, pointed in opposite directions, give a grip of great power. By applying a universal joint to the connecting shaft, the dogs may be attached to head blocks independent of each other, so that it makes no difference whether the standards move parallel with each other or not, as the dogs move simultaneously from the motion of one lever. The makers supply standards containing the dogs, which may be substituted for any other standard, winged or otherwise. These standards are made with wide faces; and as the teeth of the dog emerge from the center of the face, they have no tendency to spring the cant. Any size of log up to

Fig. 2.



18 inches may be sawn up from the first dogging, without rolling the log, as two teeth must enter the lumber, and these are sufficient to hold it securely. When the surface towards the dogs is wide, five or more teeth can be driven in, at the will of the operator.

Patented December 26, 1871, to N. F. Beckwith, and further protected by patents now pending. For further particulars address Messrs. Filer, Stowell & Co., Cream City Iron Works, Milwaukee, Wis.

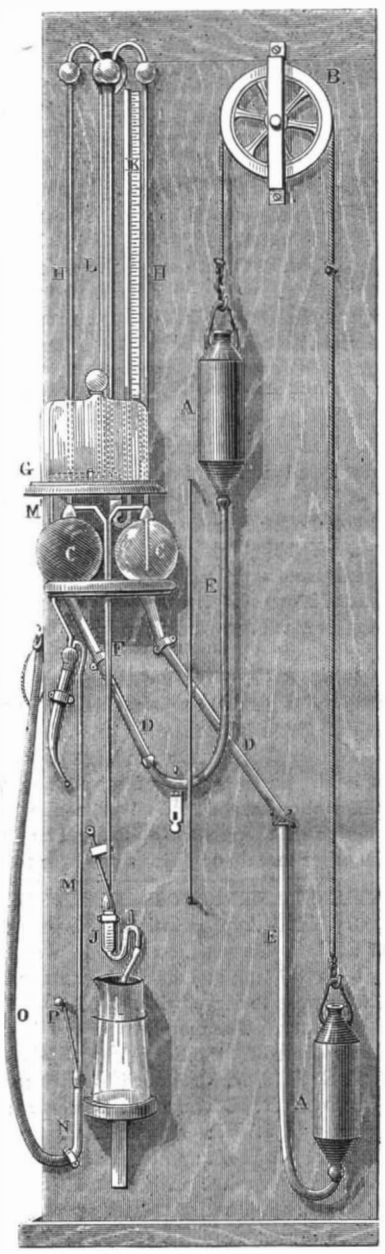
A NEW MERCURY AIR PUMP.

M. De Las Marismas has recently presented an air pump of his invention to the Academy of Sciences, Paris. It is somewhat similar to that of Mr. Sprengel, and the following advantages are claimed for it:

It is of easy and cheap construction, costing only about $7. It works rapidly and without causing fatigue. The vacuum is obtained within one millimeter (0·039 inch), in a receiver of the capacity of 1½ gallons in about four minutes. Experiments may be made at all pressures, from the atmospheric pressure up to absolute vacuum. It permits the reception of the air or gas contained in the receiver employed for experiment, and also, to within 0·039 inch, the admission of such gases as may be desired. It is self-acting, and therefore avoids all those errors incidental to the working of mercury air pumps of which the cocks are obliged to be worked by hand. Lastly, it can maintain the vacuum indefinitely.

The proportions of this machine, which are limited to the size of a laboratory instrument, may be augmented according to whatever requirements may be desired. Those parts which are constructed of glass may be made of iron, whenever it is not necessary to employ gases which attack that metal.

The following is a description of the instrument:



This machine is composed of two reservoirs of cast iron, A A, which counterpoise each other, and are supported by the pulley, B. They communicate with two glass balloons, C, by means of the glass tubes, D, and of the india rubber tubes, E. They are filled with mercury, which, when one of the reservoirs is lifted, passes into the balloon, and drives the air out of it, through the capillary tube, F, which is soldered to the top, at the same time that the other reservoir, in falling lower than 29·64 inches, causes the mercury to quit the other balloon, thus forming a barometric vacuum. The balloons communicate with the plate, G, by the glass tubes H, which plunge to within 0·39 inch of the bottom of the balloons. They are automatically closed as soon as the mercury rises within the balloons to drive out the air, and opened as soon as it retires to produce the vacuum. The air cannot re-enter the balloons by the tubes, F, after having been once driven out, because, in order to escape by the orifice, I, it is obliged to pass through a slight layer of mercury contained in the curved tube,; J and when the vacuum is formed in the balloons, the atmospheric pressure causes the mercury to mount up again in the tubes, and thus prevents the return of air. In order to receive the air or gas contained in the plate, or in the vessel to be experimented on, all that is to be done is to place the required recipient in communication with the orifice, I.

The degree of vacuum produced is indicated by the baro meter, K, which communicates with the plate by the tube, L, and enables experiments to be made at all pressures comprised between atmospheric pressure and absolute vacuum.

The return of the air is effected through the tube, M, which communicates on one side with the plate, and on the other plunges into the mercury contained in the bent tube, N. The level of the mercury may be changed by elevating or lowering the india rubber tube, O, and thus uncovering at will the extremity of the tube, M; the return of the air upon the plate is regulated to within 0·039 inch.

If it is wished to admit any other gas, the recipient containing it must be placed in communication with the tubular opening, P.

We select the engraving from the pages of the *Practical Magazine.*

DITTMAN'S IMPROVED LOCKING NUT.

The nut lock herewith illustrated, in perspective (Fig. 1) and section (Fig. 2), is so constructed as to prevent the backward rotation of the nut under the influence of jars and

Fig. 1

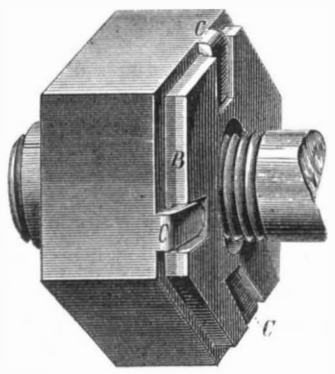
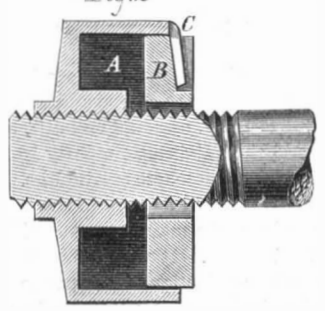


Fig. 2



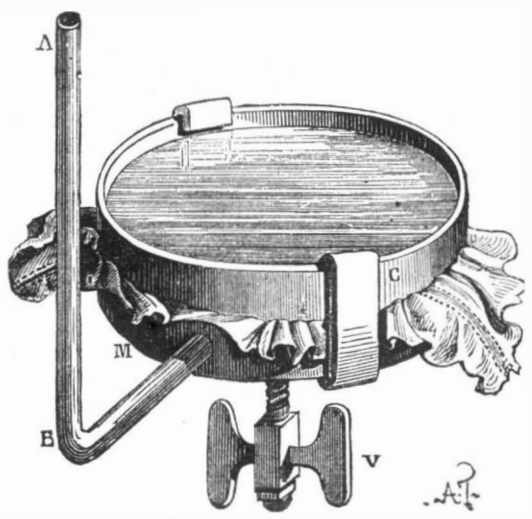
jolts, and also to take up automatically the expansion or contraction of the bolt, due to changes of temperature.

An iron nut is provided with an outer higher shell, the space between forming a chamber to receive the rubber, A. The latter extends almost to the top of the shell, and is, by the compressive force of a follower, B, expanded until it comes in frictional contact with the threads of the bolt. This prevents the nut from turning on the bolt, as the rubber serves as a lock, while the expansion and contraction of the bolt are taken up by corresponding expansion and contraction of the rubber. The washer or follower, B, has recesses inclined at the bottom and adapted to receive the lips, C, which project upwardly from the edge of the shell. This serves the purpose of holding the parts of the device together for transportation, etc., while it also locks the washer to the nut when the latter is screwed down upon a fish or other plate.

Patented through the Scientific American Patent Agency, September 8, 1874. For further particulars regarding sale of entire right during the next twenty days, or relative to licenses thereafter, address the inventor, Mr. Caspar Dittman, Leacock, P. O., Lancaster county, Pa.

APPARATUS FOR DETERMINING THE IMPERMEABILITY OF TISSUES.

We extract from *La Nature* the annexed illustration of a simple device for determining whether or not any given tissue is impermeable to gases. The utility of the device is principally found in testing silk and other fabrics used for



balloons, or for proving waterproof varnish when spread on tissues.

The apparatus is a metallic cup, M, to which a tube, A B, is affixed. The material to be tested is placed over the mouth and there strained between a band of rubber (attached to the exterior of the cup) and a ring, C, held in place by double clamps and a set screw. The fabric is then covered with water and air is blown in through the tube. If the stuff is not absolutely impermeable, minute air bubbles will make their way through and rise in the water.

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THE SUN'S POSITION AT DIFFERENT SEASONS OF THE YEAR.

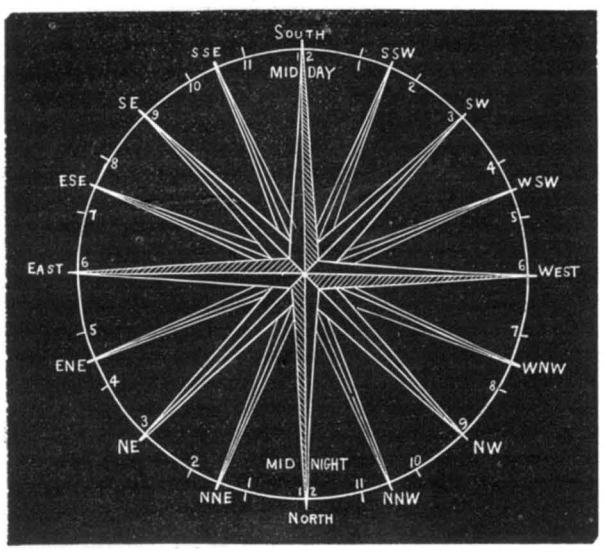
It is a universally known fact, says Herr Jaffe, in consequence of the inclination of the earth's axis at the ecliptic, the sun sometimes stands higher and sometimes lower over the horizon. It is, however, less known that, simultaneously with this change of altitude, a variation also takes place in the sun's relative position to the points of the compass. With us, as in the whole temperate zone of the northern hemisphere, the sun's position at noon is due south; and from this one is led to assume, since the earth performs a revolution every twenty-four hours, and every point upon its surface describes an entire circle, that the sun always stands in the east at six A.M., in the west at six P. M., in the southeast at nine A. M., and in the southwest at three P. M., etc.

At Vienna, on the 48th degree north latitude, the following, however, is proved to be the case. The sun stands:

	E. A.M.	S.E. A.M.	S. NOON.	S.W. P.M.	W. P.M.
On the 21st December . .	—	9·10	12	2·50	—
On the 21st March . . .	6·0	9·50	12	2·10	6·0
On the 23d of September .	6·0	9·50	12	2·10	6·0
On the 21st of June . . .	7·10	10·30	12	1·30	4·50

Whoever wishes to test the accuracy of this statement should proceed as follows: Divide the circumference of a circular dial, Fig. 1, into twenty-four equal parts, mark these

Fig. 1.

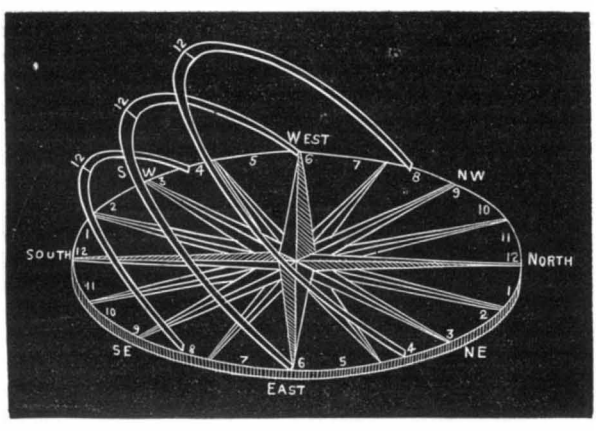


divisions with the numbers of the hours, from one to twelve A. M., and from one to twelve P. M. Then draw upon it the dial face of a compass, so that the south may coincide with twelve, noon. Then cut three narrow circles of the same circumference as the dial, and divide and mark their outer edges with the hours in the same manner as before. Cut one of the circles off at eight A. M. and four P. M., the second at six A. M. and six P. M., and the third at four A. M. and eight P M., and fasten the ends of all three arcs to the corresponding hours upon the dial, so that they are inclined towards the south at an angle of 42° to the dial. Fig. 2 is a perspective view of the finished model.

The parts of the circles cut off represent the sun's orbit as it appears to us in Vienna, Munich, and all other places which lie 48° north—the first on the 21st December (the shortest day), the second on the 21st March and 23d September (when the days and nights are equal), and the third on the 21st June (the longest day). In order to find out the sun's position at a given hour on any of these days, one has only to let fall a perpendicular from the particular hour and arc to the face of the dial, and read off the name of the point of the compass on which the line falls.

The sun's position for all the other days of the year is very easily reckoned when once the four already spoken of are found. Naturally, the construction of the model has to be changed for different degrees of latitude. The further

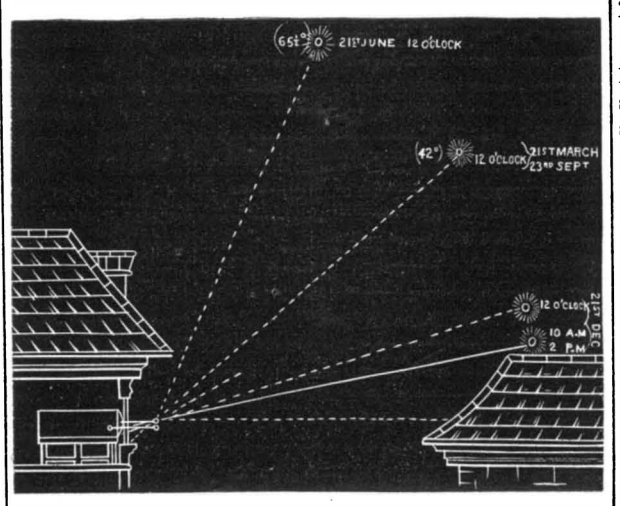
Fig. 2.



north the longer the longest day will be, the shorter the shortest day, and so on. Also the angle which the segments of circles must make with the dial will be altered, this angle always expressing the difference between the number of the degree of latitude and 90. For example: For St. Petersburg, on the sixtieth degree of latitude, the angle would be 30°: For Naples, Madrid, and Constantinople (41° N. lat.), it would be 49°.

Many a photographer must have wondered how it is that the same building should be touched by the sun's rays on one side in winter at a given hour of the day; and at the selfsame hour in summer, it should be touched on the opposite side. To such a one the foregoing statement would be useful, if he wishes to decide upon a time and site for building, by means of a compass, a helioscope, or Wehl's "Guide to Building," since a beautiful shadow really contributes to

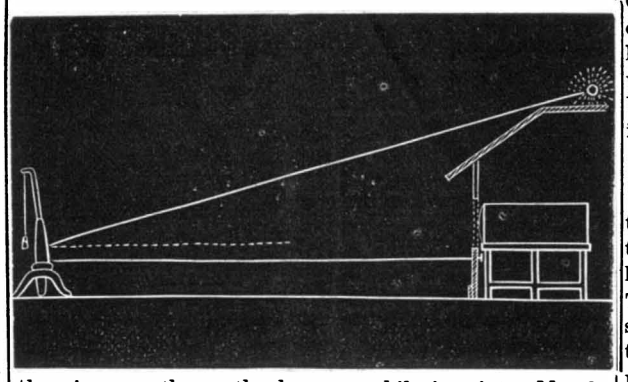
Fig. 3.



the perfection of the picture. Indeed, by means of this model, one can always study the shadows as they would be produced by the sun's rays falling on a building favorably and definitely situated, both geographically and with reference to the points of the compass. For this purpose the model must be pretty large. Take it into a dark room and set up, upon the dial, the model of a building with prominent pillars, ornaments, projections, etc., taking care that the model of the building about to be observed is placed exactly on the center of the dial and in the desired direction of the compass. The light of a candle held to one of the arcs will show the direction in which the shadows will fall on the building on that day of the year for which the arc is specially constructed. The foregoing would also prove useful to any one looking out for a site for a studio or an enlarging apparatus, especially the latter, since the angle formed by the arc of the 21st December and a line raised from the center of the dial is that by which the mirror will receive unobstructed light and be struck by the sun's rays on the shortest day. At Vienna, on December 21, at noon, this angle falls as low as 18½°, and at ten A. M. and two P. M. yet 5° lower, so that the sky would only be unobstructed for 13½°; and about Christmas the illuminating power of the lens is diminished below the point of utility. (See Fig. 3.)

It may be remarked here that for the latitude of Vienna an enlarging apparatus, erected on Wothly's system, with the mirror in the north as shown in the diagram, Fig. 4, is much to be preferred to that on Monckhoven's system, with

Fig. 4.



the mirror on the south; because, while in winter Monckhoven's mirror only gives sunlight to a small part of the lens, by Wothly's system the whole of it can be illuminated at every season of the year, as the mirror must be placed about eight times the diameter of the lens distant from it, thus allowing the whole of its plane to receive the sun's rays even in the shortest days. Another advantage of Wothly's system consists in this, that no direct rays of the sun fall on the combination lens. With Monckhoven's mirror this is unavoidable.

In conclusion, we will only make one more remark. A single glance at our model shows that the sun's ascent from ten to twelve, and its descent from twelve to two o'clock, is very slight, while before ten it rises rapidly, and after two it falls as quickly to the horizon. This is, then, the reason why the light from ten to two possesses about equal power, while it increases rapidly up to ten, and from two decreases again with the same rapidity.—*Photographische Correspondenz.*

The Duration of Life.

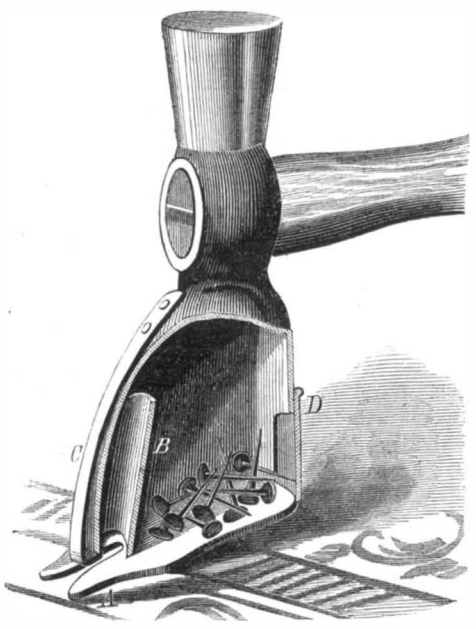
The following facts on the duration of life appear in the *Deutsche Versicherungs Zeitung*: "In ancient Rome, during the period between the years 200 and 300 A. D., the average duration of life among the upper classes was 30 years. In the present century, among the same classes of people, it amounts to 50 years. In the sixteenth century the mean duration of life in Geneva was 21·21 years, between 1814 and 1833 it was 40·68 years, and at the present time as many people live to 70 years of age as 300 years ago lived to the age of 43.

A New Kind of Poisonous Dress Goods.

Professor Gintl says that in some English and Alsatian print works the expensive albumen is partially replaced by glycerin-arsenic and acetate of alumina. Some of the dress goods in the market contain 3 or 4 grains of arsenic in a yard of the stuff. Muslins and cambrics with little white spots, circles, stars, or flowers, on a violet ground, and those printed with brownish yellow or reddish brown patterns, have been found to contain arsenic; and these are colors which have never before been considered with any suspicion, and would be purchased by the uninitiated without any foreboding of the danger that would attend the wearing of such dresses. The danger is no slight one: for aside from the large quantity of arsenic in it, the compound is not an insoluble one. If the goods are soaked in water, there is dissolved out a sufficient amount of arsenical salt to give a distinct reaction. This latter peculiarity is explained by the supposition that the goods, being comparatively cheap, are not washed or rinsed after printing, but sent directly to be finished.

A NEW TACK HAMMER.

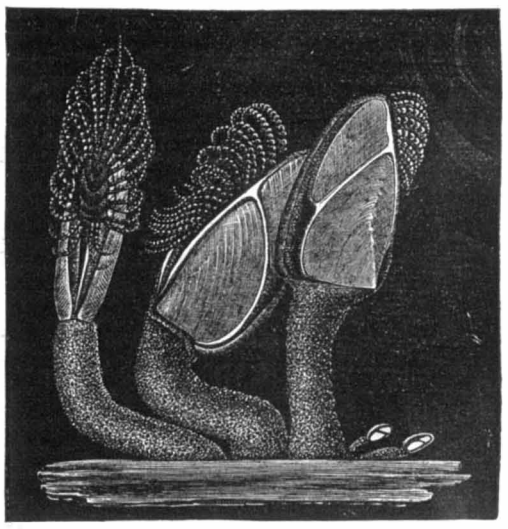
Any one who has ever drawn a tack from the floor, with the usual claw found on tack hammers, has doubtless seen the tack yielding to a sudden jerk, spring out of the board, and disappear into some hidden fold of the carpet, there to remain until it finds its way into somebody's foot or fingers. Mr. George H. Ryer, of this city, has devised a way of preventing that difficulty, by forming a receptacle in the rear of the hammer head, as shown in the annexed engraving. The base of this chamber is a steel plate having at its front end



forked projections, A, the slit between which extends back into the plate. Just in rear of the slit is a curved piece, B, and at the opening between plate and receptacles is a spring, C. The head of the tack enters the slit as represented, and easily passes the spring. A downward movement of the handle then draws the tack, which, falling on the piece, B, when the hammer is tilted back, slides into the receptacle. When the latter is full its contents are emptied out, on opening the slide at D.

THE ANATIFA.

The anatifas are among the most curious inhabitants of the ocean world. They are a kind of barnacle, attaching themselves to drift wood, rocks, and vessels, and supporting life upon minute animalculæ gathered from the sea water. The structure of the creature consists of a calcareous miter-shaped shell, composed of five pieces, two on each side and the fifth on the dorsal edge. The shell rests upon a thick pedicle, which is tubular, flexible, opaque, and of a brown color above, shading off to a flesh tint below. The animal has no power of locomotion except in swaying slowly to and fro. In order to obtain food, it is provided with twelve or



more arms on each side, which are closely contracted when in repose; but when sweeping the adjacent water for animalculæ, are widely extended. The two sexes are associated in the same individual. The young, on emerging from the egg, swim about with ease, being provided with large movable fins and a huge eye in front. These organs disappear in the adult, as it gradually becomes fixed by its pedicle.

Ancient naturalists held the queer fancy that these creatures were legged eggs, deposited by some bird like a duck, and up to the present time fishermen have a similar superstition, probably due to the feathery appearance of the arms when spread out.

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Correspondence.

The Plague of Flies.

To the Editor of the Scientific American:

Mr. William Steele is not the only person in the country whose troubles from the encroachments of insects are sufficient to inspire a wish for the invention of some infernal machine to extirpate such pests as sand flies, fleas, etc. But it seems to me that the dissemination of Science and a better knowledge of entomology are what is most needed in this direction.

I have not seen a bedbug or a flea in my house for many years. If an army of them were to be brought in, mercury would speedily exterminate them, but I think cleanliness the best and perhaps the only preventive. The common house fly I do not molest, believing that it more than compensates for its trouble by clearing the atmosphere of effluvia and the animalcules which always arise from the putrefaction of decaying substances during warm weather. So, also, with the birds, which are quite numerous here during the summer; instead of shooting them, or setting up scarecrows to frighten them away, I throw out every possible inducement for them to build their nests in my fruit trees. The birds cap ture a large share of the insects in the larval state, and thus the millers are prevented from depositing eggs for a future crop of worms. As to the loss of fruit by the birds, the latter are always sure to be on hand in force in the season of ripe fruit, whether they come early enough to take the worms or not. For the residue of insects which infest my vegetable garden, I find that the laboratory of the chemist furnishes materials fatal to them all, among which white hellebore and cayenne pepper are of the most utility; the bug or worm which cannot find vegetation unflavored with these articles will seek its breakfast elsewhere, and leave my garden unmolested. A few drops of carbolic acid in a pint of water will clean house plants from lice in a very short time. If mosquitoes or other bloodsuckers infest our sleeping rooms at night, we uncork a bottle of the oil of pennyroyal, and these insects leave in great haste, nor will they return so long as the air in the rooms is loaded with the fumes of that aromatic herb. If rats enter the cellar, a little powdered potash, thrown into their holes or mixed with meal and scattered in their runways, never fails to drive them away. Cayenne pepper will keep the buttery and storeroom free from ants and cockroaches. If a mouse makes an entrance into any part of your dwelling, saturate a rag with cayenne in solution and stuff it into the hole, which can then be repaired with either wood or mortar. No rat or mouse will eat that rag for the purpose of opening communications with a depot of supplies. CHARLES THOMPSON.

St. Albans, Vt.

The Sun's Orbit and Rate of Motion.

To the Editor of the Scientific American:

In your issue of March 27, 1875, page 196, Mr. John Hepburn makes a singular oversight, in confounding the angular motion of the earth's pole with the linear motion of the sun and solar system in space, which he makes about 8,000,000 miles a year; whereas the calculations of our best standard astronomers make it at least 200,000,000 miles, and some make it more than three times as much. The time of the great revolution has been stated at from 10 to 30 millions of years, instead of 25,800; and the great orbit at least 240,000 times as large as that of Neptune, instead of 12 times.

For the benefit of your readers who are not acquainted with mathematical astronomy, I will give you simple illustrations of these two motions. Draw a small circle on paper, and make a spot in the center for the earth's orbit and place of the sun. Make a rude top, with a wheel, an inch in diameter. Let the pointed end of the axis project ¼ inch. This axis and plane of the wheel will make nearly the same angles, with the plane of the paper on the table, as the earth's axis and equator with the ecliptic. Put the point of the axis on the circumference of the circle, keep it in the same place, and roll the wheel round on the paper. The axis describes a cone, pointing differently at each successive instant; and if the axis were extended to the ceiling overhead, or to the heavens, it would describe a circle there. If, while rolling the wheel round the pivot, you moved the pivot round the circumference of the circle on the paper, the axis would ascribe a like cone and circle. When you have rolled the wheel half way round, the axis will make an angle, with the line on which it was at the start, twice as large as the plane of the wheel makes with the plane of the paper, but all the time at the same angle with the plane of the paper. Similarly to this, the axis and pole of the earth describe a cone and circle in the heavens; but so slowly does the earth's axis vary from parallelism, that it takes 25,800 years to complete the circle. The linear motion of the sun in space may be aptly represented by carrying an orrery round the world. The contrast between the circle on the paper and the circle of the earth is no greater than that between the earth's yearly circuit round the sun, and the sun's great circuit round some inconceivably distant central sun.

Kankakee, Ill. S. N. MANNING

Kaolin in the United States.

To the Editor of the Scientific American:

In your recent article on "Porcelain Manufacture in New York," you tell us that the kaolin used is imported from England, and you regret the necessity for so doing, and express the opinion that there is no reasonable doubt that the material exists within our own borders. If by "our own borders" you mean the State of New York, you are possibly correct; but if by it you mean the United States, you are laboring under a mistake such as, after a quarter of a century's reading of your excellent paper, I have never before known you to fall into. Kaolin of excellent quality is found from the Valley of Virginia in the East to Arkansas in the West, and it abounds in North Carolina, Tennessee, Georgia, Alabama, and the northern portion of Mississippi, and I think that it (as well as a very superior quality of lithographic stone) has very recently been found in Kentucky. In South Carolina, kaolin is very abundant and of superior quality. During the late war, quite a large amount of table ware was made at the Kaolin Mine, as it is called, in Edgefield district (I think that is the name), some 10 miles south of Augusta, Ga. During the war, I used in my house some of the ware; and though rather roughly fashioned, it was equal in point of color and strength to any other porcelain.

Since the war, the manufacture of the ware, I think, has been abandoned; yet large quantities of the clay have been shipped (thousands of hogsheads yearly) to your own city, where, I understand, it is sold to paper makers, candy makers, and manufacturers of wall paper, as a substitute for *terra alba*. You will find on inquiry large stocks of it in your city, and is most likely sold as an imported article; and quite likely the "slip" alluded to in your article is from the South Carolina mines. If any of the other States have ever engaged in shipping it abroad, I am not aware of it.

Nashville, Tenn. S. D. MORGAN.

The Steam Climber.

To the Editor of the Scientific American:

In a recent issue I find an account of a steam hill climber, as you term the new locomotive for the U. I. & E. R. R. The engine in question was built at the Mason Machine Works of this city, and was designed to run both on a level and an incline. Perceiving several errors in your short notice of it, I imagine that you will be glad to receive a few correct dimensions. The small double-flanged wheels are 27 inches in diameter, and the track they run on is 9 inches above the outer rail, which is of the usual gage. The main drivers are 3 feet 6 inches in diameter, and consequently clear their rails ½ inch when the small ones come into play. The cast steel cog wheel is placed between the small wheels, of course on the back axle only, to which the main rod is attached; it is 8 inches wide, and its teeth have a pitch of 4 inches, while its pitch line diameter is 27 inches. You will notice that the power at the rim of the small wheels (which is also the pitch line of the gear) is much greater than at the rim of the main drivers, because of the increased leverage, which is also an advantage in climbing.

The engine is a double-truck locomotive, designed to allow each truck to swivel on its centers, similarly to the Fairlie system. There are six drivers of 3 feet 6 inches diameter, with 4 inch centers; the cylinders are 17 x 24 inches; the boiler has a fire box, 66 inches long by 48⅝ wide, inside, with 154 two inch tubes 11 feet 6 inches long; the tank has a capacity of 2,530 gallons. The tank end is supported on a six wheeled truck, with four sliding side bearings under the frame, and is so arranged that the truck swivels on its center piece. The engine weighs about 32 tuns on its drivers, and is fitted with the Walschaert valve gear, which is quite familiar to European engineers, but has not yet received the attention in this country which it deserves.

I enclose a photograph of the engine, which is appropriately named the Leviathan.

Taunton, Mass. WM. E. SPARKS.

Dry Plate Photography.

To the Editor of the Scientific American:

No doubt many of your readers who may be interested in practical photography, particularly in preparing plates for the dry process, have often experienced difficulty in applying the preparatory coating of albumen smoothly, unless they resort to the careless general practice of first dipping the plate into water, which so largely dilutes the mixture as to seriously lessen, when it does not entirely destroy, its efficacy. The result is that, in subsequent operations, the film is liable to slip, and thus destroy the value of the negative.

For a long time I experienced much annoyance myself from this source, until I discovered that all difficulty could be obviated by simply breathing upon the plate before pouring on the albumen, when the solution will be found to flow as smoothly and evenly as the best collodion. If during the application the fluid shows any hesitation in covering a particular spot, it is only necessary to again breathe upon that point, and the difficulty will be removed.

I. HENRY WHITEHOUSE.

Ouchy Lausanne, Switzerland.

Parasites in the Tongues of Flies.

To the Editor of the Scientific American:

A few months ago, when examining with a microscope the tongues of house flies, I discovered in the tongues of several a species of worm. In some flies, I found two worms, in others one, and in others none at all.

If among your subscribers there is any microscopist who can give some information concerning these parasites, it would be interesting to many to hear from him. The worms were found about the spiral glands; they were transparent in appearance, head and tail being exactly alike. They were very active in their motions. W. W. W.

Cincinnati, Ohio.

The Wild Sheep of California.

The California species (*ovis montana*) is a noble animal, weighing when fully grown some 350 pounds, and is well worthy the attention of wool growers as a point from which to make a new departure. That it will breed with the domestic sheep I have not the slightest doubt, and I cordially recommend the experiment to the various wool growers' associations as one of great national importance.

The clothing of our wild sheep is composed of fine woo and coarse hair. The hairs are from about two to four inches long, mostly of a dull bluish-gray color, though varying somewhat with the seasons. In general characteristics they are closely related to the hairs of the deer and antelope, being light, spongy, and elastic, with a highly polished surface; and though somewhat ridged and spiraled, like wool they do not manifest the slightest tendency to felt or become taggy. A hair two and a half inches long, which is perhaps near the average length, will stretch about one fourth of an inch without breaking. The number of hairs growing upon a square inch is about 10,000; the number of wool fibers is about 25,000, or two and a half times that of the hairs. The wool fibers are white and glossy, and beautifully spiraled into ringlets. The average length of the staple is about an inch and a half. A fiber of this length, when growing undisturbed among the hairs, measures about an inch; hence the degree of curliness may easily be inferred.

Wild wool is too fine to stand by itself, the fibers being about as frail and invisible as the floating threads of spiders, while the hairs against which they lean stand erect like hazel wands; but notwithstanding their great dissimilarity in size and appearance, the wool and hair are forms of the same thing, modified in just that way and to just that degree that renders them most perfectly subservient to the well-being of the sheep. Furthermore, it will be observed that these wild modifications are entirely distinct from those which are brought by chance into existence, through the accidents and caprices of culture.

It is now some 3,600 years since Jacob kissed his mother and set out across the plains of Padan-aram to begin his experiments upon the flocks of his uncle, Laban; and, notwithstanding the high degree of excellence he attained as a wool grower, and the innumerable painstaking efforts subsequently made by individuals and associations in all kinds of pastures and climates, we still seem to be as far from definite and satisfactory results as we ever were. In one breed the wool is apt to wither and crinkle like hay on a sun-beaten hillside. In another, it is lodged and matted together like the lush-tangled grass of a manured meadow. In one the staple is deficient in length, in another in fineness; while in all there is a constant tendency toward disease, rendering various washings and dippings indispensable to prevent its falling out. The problem of the quality and quantity of the carcass seems to be as doubtful and as far removed from a satisfactory solution as that of the wool.

The source or sources whence the various breeds were derived is not positively known, but there can be hardly any doubt of their being descendants of the four or five wild species so generally distributed throughout the mountainous portions of the globe, the marked differences between the wild and domestic species being readily accounted for by the known variability of the animal. No other animal seems to yield so submissively to the manipulations of culture. Jacob controlled the color of his flocks merely by causing them to stare at objects of the desired hue; and possibly merinoes may have caught their wrinkles from the perplexed brows of their leaders.—*John Muir in the Overland Monthly.*

Colored Confectioneary.

It may not be uninteresting to some of our readers to see what kind of poisons are administered in the form of colored candy to the young Hungarians at home. Professor Ballo, of Pesth, who has been analyzing them, reports that, in 13 specimens of red candy which he tested, he found that 11 were colored with cochineal and 2 with fuchsin. Of 12 blues, 2 were ultramarine, 1 indigo-carmine, 2 aniline blue, and 8 Prussian blue. Of 83 yellows, 31 were chrome yellow, 49 were Dutch pink, and 3 a salt of binitro-naphthol. Of 18 greens, 4 were Paris green, 8 chrome green, 2 ultramarine green, and 4 sap green. The so-called iron yellows were chrome yellows, and the so-called substitute for carmine was an arsenious fuchsin. Of these colors the Paris green, chrome green, and chrome yellows are poisonous; and their use should be prohibited, and so should that of fuchsin, for only the cheaper and arsenious sorts are used. The action of binitro-naphthol salts is entirely unknown, and hence their use should not yet be permitted. To make the confectionery cheaper, its weight is increased by sulphate of baryta and other adulterations.

GREAT BRITAIN AT THE CENTENNIAL.—We are glad to announce that Mr. F. R. Sandford, a gentleman of great administrative abilities, who was Secretary of the Commissioners of the London Exposition of 1862, and Mr. Philip Cunliffe Owen, who had charge of the British delegation to the recent Vienna Exposition, have been appointed to take charge of their country's interest at the approaching Centennial.

A SHAFT has been sunk at Lawton, Eng., for the purpose of pumping up brine, to be conveyed by pipes to the coke ovens in connection with a colliery, a distance of two or three miles, there to be converted into salt by means of the waste heat from the ovens. The cost of the undertaking will, it is said, exceed $200,000.

SOME of the large sugar manufactories of Paris are now illuminated at night by the electric light obtained from the Gramme machine. The apparatus requires from 1 to 1½ horse power, and is driven from the engine the same as any other piece of machinery.

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A CHINESE PATENTEE.

We herewith introduce the first Chinese patentee to the American public. He is a resident of San Francisco, Cal., and his invention is a pair of overalls, the novelty of which consists in forming a gusset or triangular lap upon the piece of material which comes opposite the corner of the pocket or other termination of a seam, and then sewing the lap or gusset down across the seam.

A represents a pair of overalls. In order to fasten the corners of the pocket and the termination of other seams in the overalls, a triangular or other shaped piece of cloth, *b*, is left projecting from the piece of cloth opposite the corner of the pocket, and this small piece, *b*, is lapped over the corner of the pocket or seam, and sewn down firmly all around, so that it will form a gusset for strengthening the corners of the pocket, and prevent them from ripping or being torn by any ordinary strain that may come upon them. This piece, *b*, is formed in the proper place when cutting the cloth for the part, so that it forms a permanent part of one of the pieces of the overalls, and is, therefore, much stronger and more durable than if it were a separate piece sewn on over the seam. This form of fastening, says the inventor, also gives the overalls a much neater and more durable appearance; and the re-enforcing lap, instead of being a separate and independent piece of goods sewn to the garment, is a part and parcel of the body of the garment, and cut in one piece with it, thus not only avoiding the necessity of a separate re-enforcing piece, but also avoiding one seam, which would be necessary to secure a gusset as usually cut.

For further particulars address the inventor as above.

CHEANG QUAN WO'S OVERALLS.

Sir Goldsworthy Gurney.

With regret we record the death, at the age of 82, of Sir Goldsworthy Gurney, a man of considerable eminence as an inventor. He was the son of Mr. John Gurney, of Trevorgus, in Cornwall, and was born in 1793. He was educated for the medical profession. He gave lectures on chemical science at the Surrey Institution in London. But his career was invested with peculiar interest for engineers, by his connection with steam locomotion on common roads. He constructed a little locomotive, which worked successfully with ammoniacal gas, and the results of his experiments were so satisfactory that he subsequently built a steam road carriage. In 1826 he ran this carriage several trips in the neighborhood of London, ascending Highgate Hill without difficulty. A description of this carriage will be found in the seventh edition of "Lardner on the Steam Engine," published in 1840. In 1831 a carriage built by Gurney, for Sir Charles Dance, ran regularly between Gloucester and Cheltenham, for four months, four times a day, during which time it carried about 3,000 passengers, and ran 3,564 miles. Generally the distance, nine miles, was run in 55 minutes. Gurney invented the oxyhydrogen or Bude light, so called from his Cornish residence, in 1825. He carried out several improvements in connection with his system of lighting, among which was an arrangement of reflectors for dispersing the light in gradually diverging rays from the lantern, and a ventilating chandelier, which was also so contrived as to evaporate small quantities of water for the purpose of keeping the atmosphere of the room in a salutary condition. The Bude light was tried for the first time in street illumination on the 10th of January, 1842, at the crossing in Pall Mall at the bottom of Waterloo place. It is said to have illuminated the whole of the open space in which stands the Athenæum Club very powerfully, and to have caused the gas lamps to look as dim as at that time the old lamps at the end of Gower street did to the gas lamps when established. Gurney likewise devised the well known stove which goes by his name, and a method of mine ventilation, which consisted in taking high pressure steam down the shaft and then allowing it to escape in an upward direction through a number of jets. In his youth he was associated with Davies; Giddy, and Trevithick, and no doubt imbibed from them much of his love of mechanical science. Sir Goldsworthy Gurney was a magistrate for the counties of Devon and Cornwall.

Doing up One's House.

The principal reason, according to the *Saturday Review*, why so many people dread having their houses done up, is that the object of each tradesman employed seems to be to make work for some other tradesman. The whitewasher forgets to cover up the steel grate in the drawing room when he is doing the ceiling. The housemaid is so busy flirting with him, and listening to the words of the last comic song which he is trying to teach her, that she neglects to remove the fender and fire irons. Grate, fender, and fire irons are completely spoiled, and have to be sent away and repolished at considerable expense. The whitewasher also manages to clog the bell wires so that the bells will not ring. The bell-hanger must therefore be sent for. He leaves dirty finger marks upon the cornice where he has loosened the cranks, and round the china handles where he tries the bells. Perhaps he breaks one of the handles. It cannot be matched, so two new ones must be bought, and another tradesman brought in to put them on. The paper hanger possibly uses bad size on the wall, and makes his paste of damaged flour; consequently, when the room is again inhabited, it has a mysterious but most offensive smell. Perhaps he does not take the trouble to remove the old paper before putting on the new one, in which case pastiles may be burnt and windows opened, but all in vain—the smell will remain. The painter does not sufficiently rub down or burn off the old paint before he puts on the new. He sometimes even covers the old doors with size to save himself trouble and make a surface. He is almost always careless with his first coat—a carelessness he cannot afterwards repair. It is not uncommon, as soon as the new paint is quite dry, and has been under the influence of either sunshine or a hot fire, to see it starting off in pieces at the slightest touch, and leaving the light under color visible. If not carefully watched, the painter will put his pots on one of our best tables, making on it a fine confused pattern of circles great and small. In consequence of his carelessness, the polisher has to be called in. The painter is quite satisfied, having done his part towards the encouragement of trade. In giving the hall door a fresh coat, he lets drops fall on the step which no French polisher or English housemaid could, with any quantity of fuller's earth, whiten or remove. He walks up and down the oil cloth in the hall with nailed boots, and gives it the appearance of having recently recovered from a severe attack of small pox. His sympathies are with the makers of oil cloth, not the buyers thereof, so he is rather pleased. It is not uncommon for a bill to be sent in charging for four coats of paint when only two have been put on; perhaps in some cases there may have been three thin paintings and a little chalk mixed with the white lead. Common oak varnish will be charged as best copal, and the bad cotton rope with which the window sashes are mended as best hemp line. Strange to say there are people who honestly love the house painter and his paint, who like to be constantly redecorating their rooms. Men of supposed taste still have their hall doors grained in a bad imitation of oak or maple, and prefer paint on their stairs to stained and varnished wood. The reason why builders so love paint and varnish is that it hides bad wood, and insures to them and their successors work for ever. If some substitute for whitewash on ceilings could be found which would wash, they would lose thousands a year. They set their faces against the varnished papers which some people have adopted, and which are certainly a help to cleanliness at small cost, as they bear washing. They detest marqueterie floors with rugs, as there are not then heavy carpets to take up and nail down, and tear also, as we know to our cost.

Preparation of Washing Blue.

Twenty lbs. white potato starch, twenty lbs. wheat starch, twenty lbs. Prussian blue, two lbs. indigo carmine, and two lbs. finely ground gum arabic are mixed in a trough, with the gradual addition of sufficient water to form a half fluid, homogeneous mass, which is then poured out on a board with strips tacked to the edges. It is then allowed to dry in a heated room until it does not run together again when cut. It is next cut, by a suitable cutter, into little cubes, and allowed to dry perfectly. They are finished by being placed in a revolving drum, with a suitable quantity of dry and finely pulverized Paris blue, until they have a handsome appearance. The cost is about 12 cents per lb.

The Modern War Ship.

Mr. John Scott Russell, in a recent paper before the Institution of Naval Architects, says: "My personal opinion and experience have grown steadily towards the conviction that we should consider a modern war vessel as a mere tool or instrument of destruction, not a ship (in the eyes of the sailor, quite unworthy of the name), a mere floating gun carriage, a mere floating spear propelled by steam and meant first to place an explosive shell in the enemy, and second to run into his side and sink him. If I am right in supposing that what I say truly represents modern naval opinion, then we come to a very simple practical conclusion. Let us take one big gun, let us give it the largest bore, the largest shell, the highest penetrating speed we know how. Let the vessel herself be considered in the light merely of a floating gun carriage. Let this one large gun occupy the chief place in the vessel in front of her engines and boilers and propellers. Let it be as small a ship as is consistent with high speed, let it be propelled by high engine power, let it show very little above water, and let it have a short, strong, ugly stem to strike the enemy and sink him.

Not only high speed but admirable dexterity, and quickness of movement or manœuvring, are indispensable to this sort of vessel; she must be low in the water, nearly unsinkable, all her decks perfectly closed, waves must break over her without harm, she must be steady, quick, and sure.

It may be said that such a ship is hard to find and hard to make and hard to handle. Certainly she is hard to work; but is not all great, noble work hard, and are not victories always hard to win?

If you agree with me in regarding this one gunboat as the type of an effective instrument of naval destruction, the next question which naturally arises is this: When we want two guns, shall we have a two-gunboat or two one-gunboats? The arguments on this point are the following: In many practical cases of experience we find it prudent to have duplicates; we may have two pumps where one would do, we may have two cylinders where one would do, two screws where one would do, two boilers where one would do. My answer is that duplicates are useful in little things; we cannot afford them in principals, though we can in subordinate things. My personal opinion is that two large guns in two small gunboats are better than two large guns in one small gunboat. To this rule, however, I know of exceptions in these two cases: the large many gunned man-of-war, with central battery and central armor coating, and the small single great gunner. I have taken extremes, because I think both of these inevitable and indispensable to England. There is a third fleet of indispensables—I mean the cruiser. She must be an ocean steamer, large, long, fast, large gunned, many gunned, long ranged, steady, easy, good sea boat, carrying large store of coal and other stores. She must have great destructive power, great endurance, great manœuvring power, and with high speed, power to choose her own enemy, and her own time and place, and manner of action. Only she cannot be covered with armor. Also, she can, if not absolutely secured, be comparatively well protected by certain precautions which may be well considered. Let us consider these. 1. Let us put all that wants protection well under water; let us give protection by armor, if necessary, in small quantity near the midway armor line; let the whole ship be in celluiar watertight divisions of convenient, and even somewhat inconvenient, smallness, but judiciously arranged so as to be conveniently accessible for good, and conveniently inaccessible for harm. By these and many similar precautions, which I will not here enumerate, the ocean cruiser may be made the queen of the seas.

Here then are three classes of ships or fleets about which we need be in no doubt as part of the fleet of the future.

1. *The Man-of-War.*—Large, fast, enduring, many and large guns, central battery, perfectly shot-proof, engines, boilers, and magazine perfectly protected; possessing also all the protecting precautions of the cruiser, but slower and heavier; enduring, a hard hitter, and hard to hit.

Have we a fleet of these? How many have we—want we?

2. *The Single Great Gunboat.*—Long, narrow, low, fast quick, clever, ugly, and sharp, unsinkable. Of these we want, not a mere fleet, but a multitude, not numbers, but swarms, clouds.

Have we swarms of these?

3. *The Many Large Gunned Ocean Cruiser.*—Long, wide, deep-sided, fast, enduring, quick in her manœuvring, with destructive power, and small protection, able to do great harm and ready to run great risks.

Have we fleets of these ready for each of the oceans in which we have colonies, and are certain to have war?

The Suez Canal.

Late reports from Egypt state that the usefulness of the Suez canal has become much impaired through the quantity of sand blown into it at certain places, and which, if not systematically removed, will soon fill it completely. Already large vessels cannot pass each other, but are compelled to wait at the mouths of the canal until the channel is clear. It is probable that high walls will eventually be built along the banks of the canal as barriers against the sand storms which are so common.

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IMPROVED SHINGLE MACHINE.

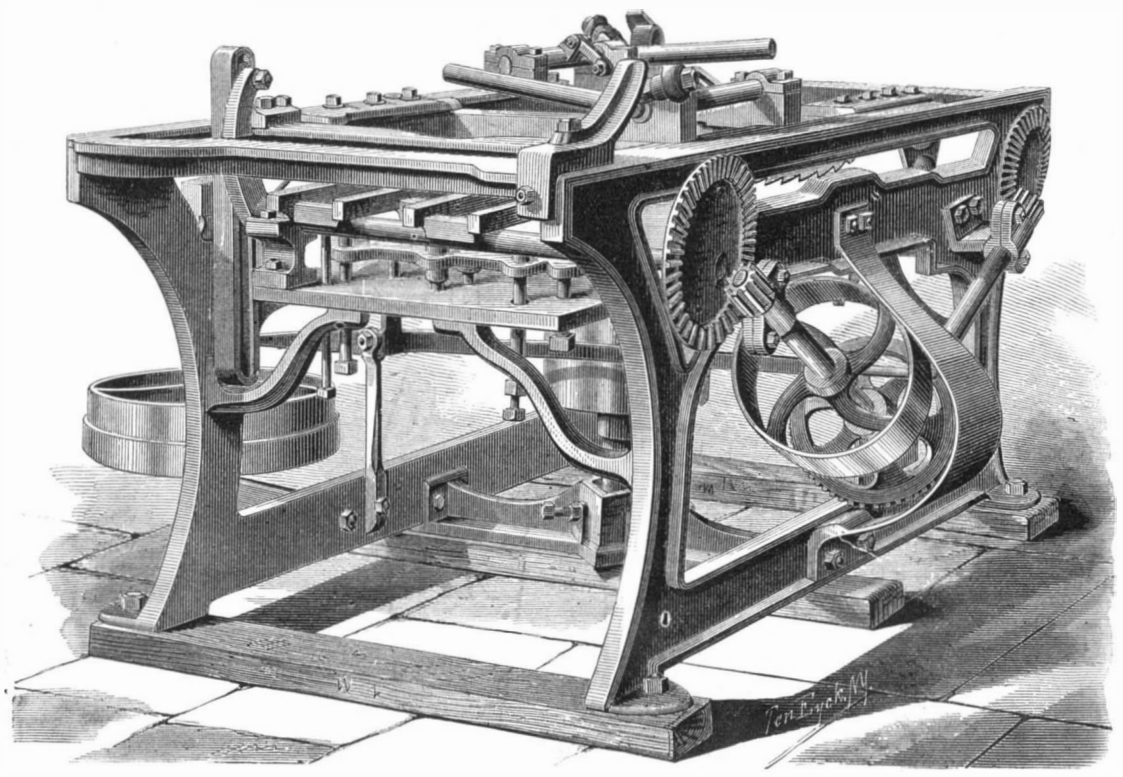
We illustrate in the annexed engraving a new shingle machine, which is adapted to cutting all kinds of wood, and which can be adjusted to cut shingles of any required thickness. It is claimed to be free from the irregular and uncertain motion of the block holders and carriages, which occurs in some other machines of like nature, and also to prevent great waste of lumber. The block holders have a gradually decreasing motion when approaching the saw, and a rapid return, these movements being imparted through the eccentric gear on the right of the apparatus. The dogs are provided with blocks of wood so inserted as to project below the iron teeth. These extend downward to the upper surface of the saw, and act as a guide, preventing the saw from striking the iron and also griping the block after it has become too thin to be held by the teeth, thereby saving much timber ordinarily wasted.

The block, by its own weight, falls into proper position for the next shingle, the accuracy of its placing not being in any wise dependent upon complicated mechanism. The side of the block is presented to the saw, which, cutting lengthwise the fibers of the wood, thus produces the shingles almost as smooth as if planed.

The apparatus represented is a double block machine having a capacity of from seventy-five to one hundred thousand shingles per day; as many as one hundred and twelve thousand have been repeatedly made, the quantity depending entirely upon the power applied, the quality of timber, and the skill of the operator.

The same manufacturers also make a single block, automatic machine especially adapted to cutting up waste in lumber mills, and also an excellent hand machine suitable for persons requiring but small quantities of shingles. Besides these, a special machine is constructed for producing shingles from 20 to 24 inches in length, and also a variety of other apparatus relating to the manufacture of shingles.

The device illustrated was patented February 27, 1872. Further particulars with reference to it, or with regard to shingle machinery and manufacture, may be obtained by addressing Messrs. W. H. Hiner & Co., Union Iron Works, Fond du Lac, Wis.



WHITE'S SHINGLE MACHINE

IMPROVED TANNING PROCESS.

The inventor of the improved tanning process, the apparatus for which is illustrated in the annexed engraving, is a practical tanner of fifty years' experience, a circumstance which probably will be alone sufficient to commend his invention to the favorable consideration of the trade. The improvement consists in connecting the vats and suspending the hides in such a way that the old liquor from the new stock is drawn into the oldest leach. It passes through and over to the next, and so on to the last, where it enters and circulates through the oldest stock suspended for tanning, and finally returns to the starting point, thus keeping in constant circulation. At the same time the old stock is softened, scoured, and re-tanned, and the old ooze is filtered through the leaches, helping to strengthen the liquor.

It is claimed that by this means the leaching is so effectual as to extract the strength from any tanning substance, and that the bark, when placed on end, will give up its strength with less bloom and gallic acid, while the hides are excluded from the air.

The hides are first soaked in water, and, if hard and dry, are softened in the wheel, B. They are then hung lengthwise (if split they are tied together at the backs) on the rack, F, beneath the wheel, C, for liming. The paddles on wheel, C, keep the liquor in agitation, while the latter is supplied from above, through the trough, D, by means of the pump, E. The constant circulation which is thus kept up among the hides during the liming, it is stated, greatly hastens the process. In order to remove the hair, the hides are placed within the wheel, C; and while rolling about therein, the lime liquor continues descending upon them, washing out the hair through the wheel, and carrying it against the rack beneath, where it is retained, clean and free from knots. The hides, on withdrawal, are placed in wheel, B, and there worked out ready for the tan. During the above operation, a segment of cross slats, placed between the floats on each wheel, so that the hides drop in the water as the wheel rotates.

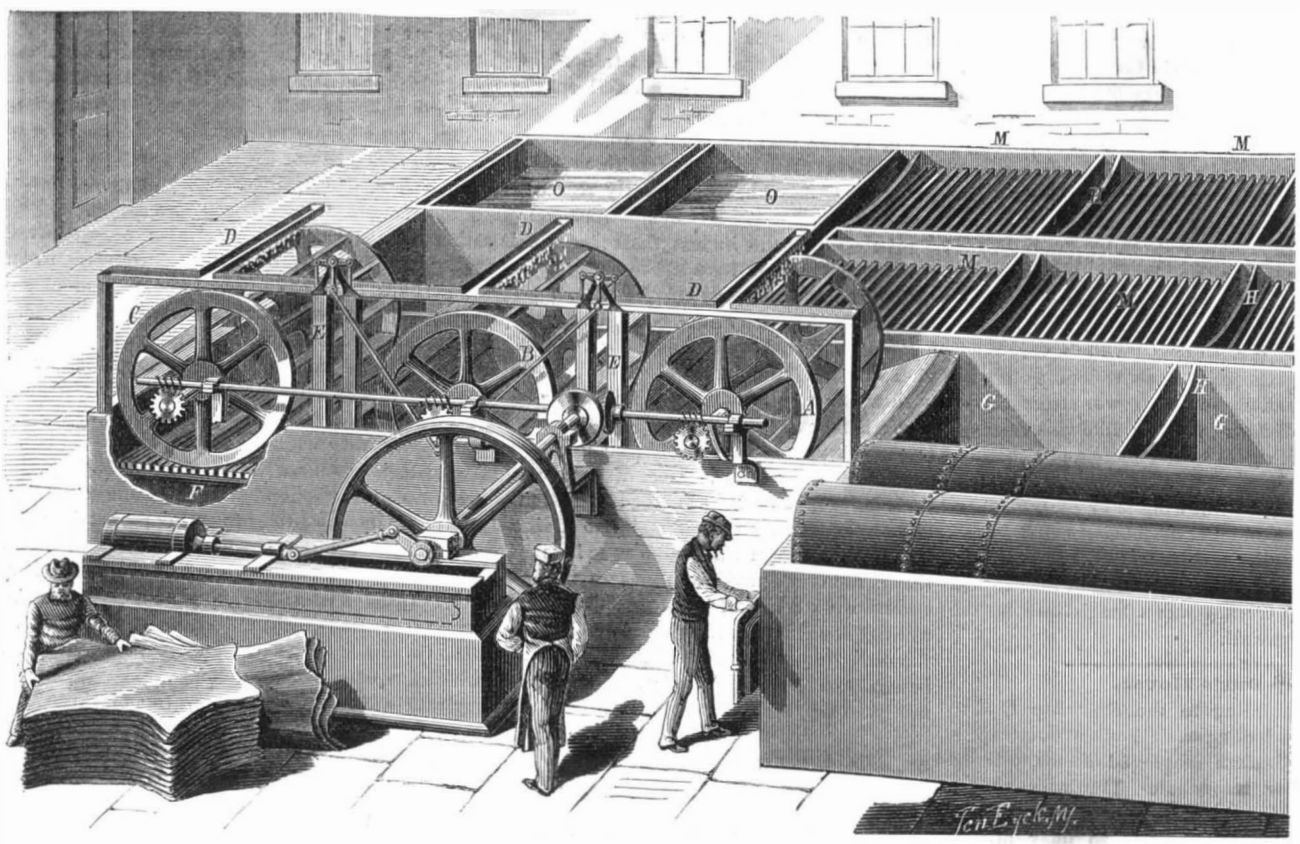
While tanning, the hides are again suspended on racks, M, which may be shifted along from vat to vat during the process, the partitions, H, being movable for this purpose, and also to allow the liquor to flow while passing through the series of leaches and tan vats. The weakest liquor is forced by the paddles of wheel, A, from the new hides, over into the weakest leach, G, where it passes through the false bottom, up the hollow partition, over into the next leach, and so to the last. Thence it returns, by reversing the circulation, back to the fresh pack from the green house.

The racks of tanned leather can be hoisted, as desired, directly into the loft, and others slid forward to make room for new ones. A false box, which is inserted in the weakest leach, may be lifted out and its contents discharged immediately into the wet tan furnace.

In currying, the wheel, A, will be found of much use, as the leather, after splitting, may be placed inside, and there scoured, softened, and re-tanned, emerging with a fair grain and fine nap on the flesh side in pliable condition, susceptible to excellent finish At the same time the old ooze is passed over and saved by filtering in the leaches. Tanned stock is greatly improved by running through the wheel, and this without the usual loss in weight.

The invention is claimed to be especially adapted to warm climates, where tan vegetation grows spontaneously The refuse, when composted with lime, animal matter, and waste from the green house, will, it is said, soon pay the cost o establishment It is labor-saving, and produces good leather in the shortest time without necessitating material innovations upon old and well tried processes.

Patented through the Scientific American Patent Agency, January 5, 1875, to Mr. Harvey Reed, who may be addressed for further particulars, care Dr. Samuel Hape, Atlanta, Ga.



REED'S TANNING APPARATUS.

Relations between Magnetism and the Aurora.

It appears from the scientific report of the Austro-Hungarian North Polar expedition of 1872–4 that magnetic disturbances are closely connected with the aurora While in temperate zones they are the exception, they form the rule in arctic regions; at least the instruments are almost in constant action. This is the case for the inclination, declination, and intensity needles.

The magnetic disturbances in the district visited were of extraordinary frequence and magnitude. They were closely connected with the aurora borealis, the disturbances being the greater, the quicker and the more convulsive the motion of the rays of the aurora, and the more intense the prismatic colors. Quiet and regular arcs, without motion of light or radiation, exercised almost no influence upon the needles. With all disturbances the declination needle moved toward the east, and the horizontal intensity decreased, while the inclination increased. Movements in an opposite sense, which were very rare, can only be looked upon as movements of reaction. The ways and manner of the magnetic disturbances are highly interesting. While all other natural phenomena become apparent to our senses, be it to the eye, ear, or touch, this colossal natural force only shows itself by these scientific observations, and has something mysterious and fascinating on account of its effects and phenomena being generally quite hidden from our direct perception.

The instrument upon which Lieutenant Weyprecht placed the greatest expectations, namely, the earth-current galvanometer, gave no results at all, through the peculiar circumstances in which the explorers were placed. He had expected to be able to connect the aurora with the galvanic earth currents. But as the ship was lying two and a half German miles from land, he could not put the collecting plates into the ground, but was obliged to bury them in the ice. Now, as ice is no conductor, the plates were isolated, and the galvanometer needle was but little affected.

DRIFTING OF ICE.

Lieutenant Weyprecht, of the Austrian Polar expedition, made the remarkable discovery that the ice never drifted straight in the direction of the wind, but that it always deviated to the right, when looking from the center of the compass; with N.E. wind it drifts due W. instead of S.W.; with S.W. wind it drifts due E. instead of N.E.; in the same manner it drifts to the north with S.E. wind, and to the south with N.W. wind. There was no exception to this rule, which cannot be explained by currents nor by the influence of the coasts, as with these causes there would be opposite results with opposite winds. Another interesting phenomenon was the struggle between the cold northern winds and the warmer southern ones in January, just before the beginning of the lasting and severe cold; the warm S. and S.W. winds always brought great masses of snow and produced a rise in the temperature amounting to 76-95° Fah. within a few hours.

The influence of extremely low temperatures upon the human body has often been exaggerated; there are tales of difficulty in breathing, etc., that are caused by them. Lieutenant Weyprecht and his party did not notice anything of the kind; and although many of them had been born in southern climes, they all bore the cold very easily indeed; there were sailors among them who never wore fur. The cold only gets unbearable when wind is united to it.

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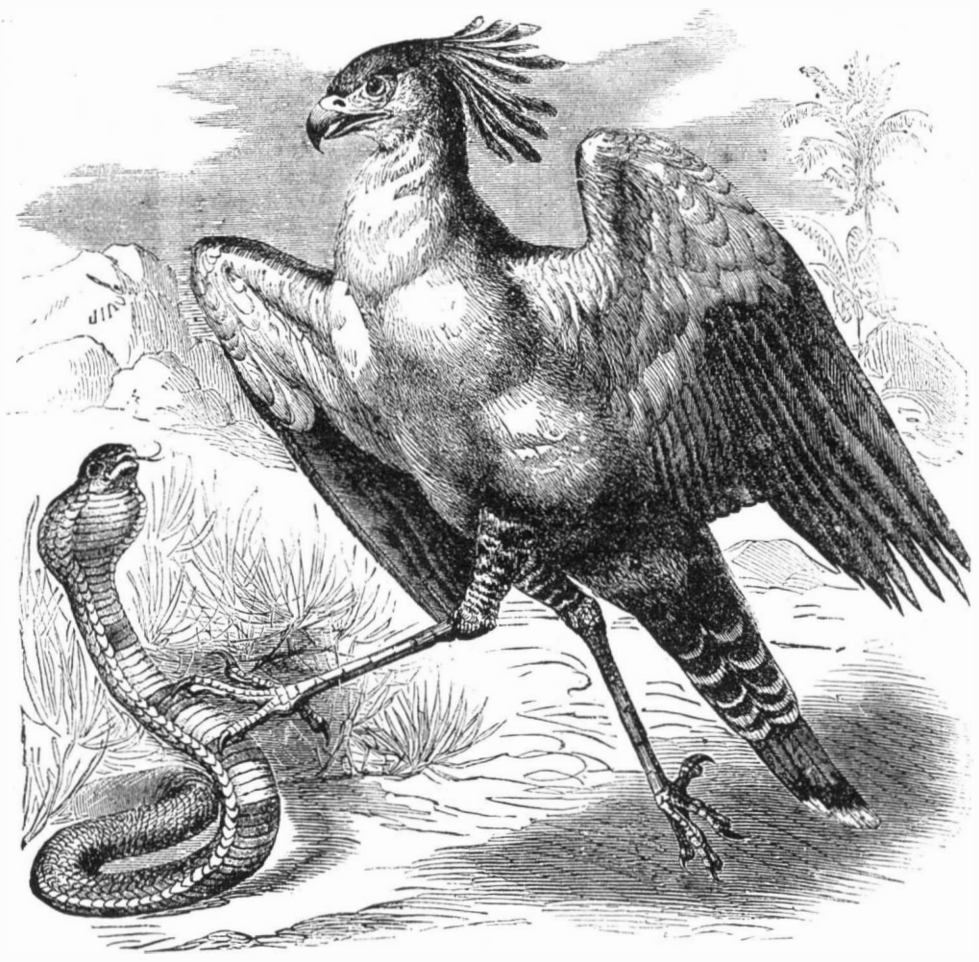
THE SECRETARY BIRD.

Many and various are the names applied to this extraordinary bird, by the natives of the different countries in which it is common. By some it is known as the "Devil's Steed," by others as the "Bird of Fate." We must own that to us these fanciful appellations are quite unintelligible, nor has any Eastern tale that we have ever read thrown a light upon their origin; nevertheless, our unpoetical imagination at once recognizes the appropriateness of its nickname of the "Secretary," as the crest upon its head, when laid back, looks most comically like the quill pens which clerks or secretaries used sometimes to put behind their ears.

Its common name is crane vulture, while it is known to men of science as the *gypogeranus serpentarius*. The crane vulture inhabits Africa, from the Cape to 15° north latitude, and from the Red Sea to Senegal; it is also occasionally seen on the Philippine Islands. One species is also met with in Northern Africa. A glance at the engraving will show that its life must necessarily be passed almost entirely upon the ground. Its toes are short, and it can walk so fast that it is sometimes called the messenger bird. When desirous of flying, it is compelled to run a short distance and then spring upward, in order to get fairly on the wing; at first it moves heavily and with difficulty through the air, but after a few strenuous efforts its flight becomes easy and regular, and it sweeps lightly and beautifully aloft, apparently without even moving its broad pinions. It finds itself, however, most at home upon the ground, and stalks over its surface with much dignity.

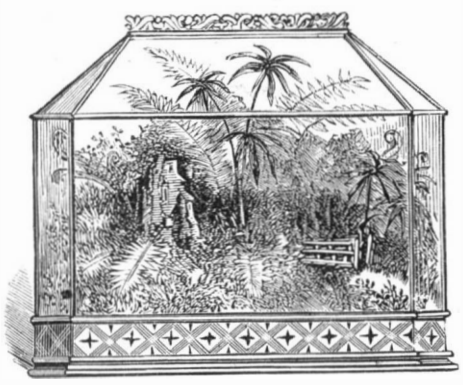


About June or July furious quarrels arise among these birds relative to the choice of a mate, the disputed female becoming the prize of the most powerful of the rivals. The pair build a nest upon a high tree, using branches and twigs plastered together with clay. The shallow interior of the nest is lined with cotton, feathers, and other soft material. It is no uncommon thing for the branches, of which the outer walls are formed, to sprout afresh and spread, until the eyrie becomes literally a leafy bower of great beauty. The eggs are two or three in number, and about the same size as those of a goose, but somewhat rounder; the shell is either pure white or slightly marked with little red spots.

Snakes of all kinds are the objects of constant attack by these birds. When a serpent sees one of these dreaded enemies approaching, it will rear itself and swell and hiss in rage and fear; but the bird will spread his wings, forming with one of them a buckler in front of him, and when the reptile makes a spring at him the bird will bound about, always presenting that hard, well-protected wing; and while the serpent is vainly spending its poison on the thick bunch of feathers, the foe is inflicting heavy blows on the defenceless head with his other wing, until, stunned and faint, the venomous creature rolls on the ground; the bird then catches it and throws and dashes it about, finally killing it with his sharp bill. Then he swallows his victim with great relish, being in no way affected by the poison it contains.—*Home and School Journal of Popular Education, Louisville, Ky.*

THE WARDIAN SYSTEM OF PLANT CASES.

The ferns have long been favorite objects of cultivation by lovers of beautiful foliage, and their infinite variety makes them a never ending source of interest. A slight expense in providing the requisite glass case and a little occasional attention will provide a very beautiful object of decoration to a home; while the tasteful selection and arrangement of the plants is a pleasing occupation for the ladies of the household.



THE SYDENHAM CASE.

We publish herewith three designs for fern cases, which we have selected from the London *Farmer*, and that journal gives the following principles upon which a fern case should be constructed: 1. Have no apparatus or arrangement for drainage. 2. Make your case as airtight as possible, allowing for no ventilation. These are very simple rules, and may seem to mean nothing; but they cover the whole ground, and, if you wish success to be the result of your labors, follow them.

Cases constructed on different principles from those of the Wardian case are necessary for the culture of other plants.

Why should we provide no drainage? The reason is that we have no ventilation. If we have no ventilation, or give no access to the air from outside, we keep the atmosphere in our case constantly charged with moisture, provided we water our plants well at the start. Ferns require, for their growth, shade and moisture; upon the former, in a great degree, depends the latter. A northern or eastern aspect, where the morning sun reaches the case, we think is best. As regards moisture, we have the principle of self-support in an airtight case; for if you allow the sun to reach the case for an hour or so in the morning, you will find that the moisture needful for the growth of your ferns is extracted from the earth; and when evening comes, this same moisture will condense and fall. Each day, this process of extraction and condensation takes place, and your plants flourish under a necessary and sufficient moisture. Now this being the kind of air we want, we must not, of course, ventilate our case, and allow it to escape, otherwise the dry air of our rooms would enter, and the watering of the case become a necessity. This at once upsets all the benefits derived from these cases. The temperature, also, must be much more even in an airtight case than in a ventilated one, where the constant opening and shutting of doors and windows would affect it. If we have no watering to do, we have no water to run off, and consequently require no drainage in the bottom of our case. Now in this airtight principle, we get at the secret.

THE WARDIAN CASE AND STAND.

STOCKING AND MANAGEMENT.

In stocking Wardian cases the amateur will find that almost all ferns and mosses will do well in this case. The study of mosses will repay the lover of Nature, and nowhere can it be so successfully pursued as here, the moisture of the case always keeping them fresh and bright, while their growth is rapid. There are few of our greenhouse ferns that will not do well under this treatment; the gold and silver ferns are perhaps the exception; they do not always attain their full size and beauty in a Wardian case, but the adiantums, pteris, polypodiums, blechnums, and others do well.

In planting a case, do not place the plants too near, nor use too many of a large size, but put in a few plants and of a moderate size. Water well after setting the plants out, and shade the case for a day or two; then give it the morning sun each day for an hour or two, and your ferns will soon start. Nothing can be more interesting than to watch them—the frond pushes its head above the earth, the heat and moisture of the case have their effect, and it gradually rises and uncurls till it reaches its hight, then it expands into the most beautiful and graceful of shapes; then what can exceed in delicacy and freshness this newly born part? The lycopodiums grow finely, and spread very rapidly in the case; small pieces introduced at regular intervals in the case will, in a marvelously short time, double their original size; and if the pendent roots of the creeping species are pressed well on to the surface of the earth, the spaces between the plants and ferns will soon be filled up, and a rich and delicate carpet be produced over the whole case. For climbers, nothing can give more satisfaction than *ficus stipulata*, which can be obtained at all greenhouses. The roots of this plant, which strike out at every joint, have an adhesive power, and will attach themselves firmly to the glass in the case, which renders the growth more rapid and regular. It is a very interesting plant to watch; the roots adhering to the glass allow a free use of the microscope, and the growth and circulation can be studied to great advantage from the outside of the case.

As to soil, the best mixture for the growth of ferns and lycopodiums is the following: Leaf mold, two parts; fresh sand, one part; gravel, about the size of a pea, one part; and stable manure, chopped very fine, one part. Ferns which grow naturally in dry places can be arranged on rockwork in the center of the case, if it is large enough to admit of it, and those requiring more moisture should be placed nearer the sides of the case, and they will get more moisture from the glass, where it deposits in great quantities. The spores of ferns can be sown on the surface of the earth in the Wardian case, and a constant supply of young plants can, in this way, be obtained, thus enabling the student to watch them in every stage of development.

It happens that not unfrequently the larvæ of insects are introduced in the earth into the case, and hatch out under the influence of the heat. To provide against this, it will be found useful and interesting to put in a small sized toad, and insects will disappear very soon, and give no further trouble. Toads will live through the winter perfectly well in this way, and their habits can be studied; some may become aware, by trying this experiment, that the toad, although not one of the handsomest of our reptiles, is not the least interesting. Experience will teach many things that cannot be laid down as rules; let us have the result of such, and we may hope ultimately to introduce the Wardian case, which is a most interesting household object, more extensively than at present.

Remember that plants of different natures and requirements cannot be successfully grown together; any amount of management will not produce it, any more than the inhabitant of the tropics can stand the changes of climate in the frigid zones.

THE PRINCESS OF WALES CASE.

Compressed Ice.

A writer in *Les Mondes* sugggests that thin ice from ponds or small pieces left after cutting blocks from larger bodies of water, might be stored in a profitable manner, and at the same time its preservation ensured, by compressing it into solid blocks by means of any simple press. In localities where ice is not attainable, snow might easily be treated in the same way.

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THE MODERN THEORY OF COLOR.

A LECTURE BY PRESIDENT HENRY MORTON, OF THE STEVENS INSTITUTE OF TECHNOLOGY.

In a lecture, recently delivered at the Stevens Institute of Technology, President Morton explained our perception of color in accordance with the generally received modern theories on the subject, which he illustrated by means of many ingenious and striking experiments. The following is the substance of the lecture:

Color, physically considered, is synonymous with wave-length, light being composed of minute undulations or waves, varying in length from the $\frac{1}{35000}$ to the $\frac{1}{60000}$ of an inch, the former being the length of the red, and the latter of the violet wave. These waves strike the eye with a velocity of 185,000 miles per second. Nearly 200,000 miles of them, therefore, enter the eye in every second; and every inch of these miles contains between 35,000 and 60,000 little waves. The whole number in a single ray is so enormous that it conveys no impression to our minds. Counting five every second, day and night, it would take about three millions of years to count what the eye receives in a single second. Yet, the eye, when perceiving colored objects, not only takes cognizance, in some mysterious way, of these rapid motions, but even distinguishes their rates of velocity. Between the rates of motion of the colors at the extremities of the spectrum, there might be an infinite number of intermediate rates, and hence of intermediate colors and shades. Evidently, however, the eye is incapable of discriminating more than a very limited number. And this brings us to the consideration of the eye itself, and the means by which we perceive color.

Fig. 1.

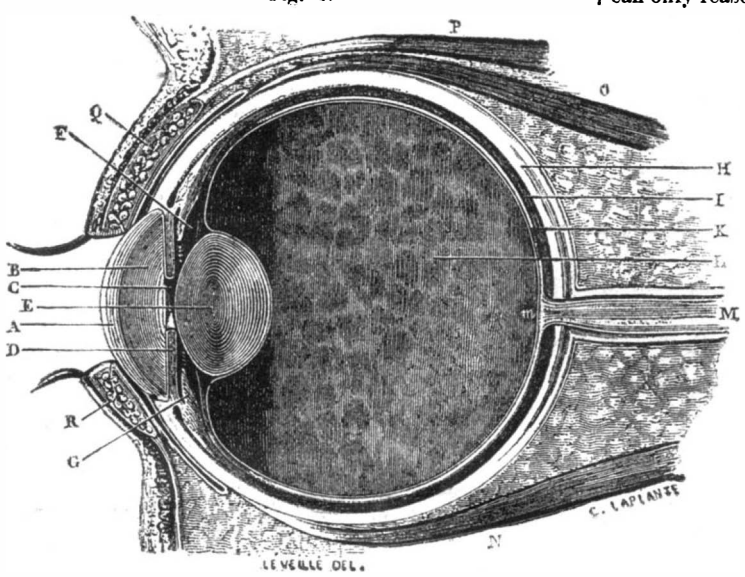


Fig. 1 exhibits the general structure of the eye. It is like a photographic camera, or dark chamber, with its lens in front and a sensitive plate behind; only, instead of being coated with collodion, the sensitive part is a hollow sphere, covered with a delicate network of nerve structure, called the retina, which it is well worth our while to examine a little more in detail.

Fig. 2.

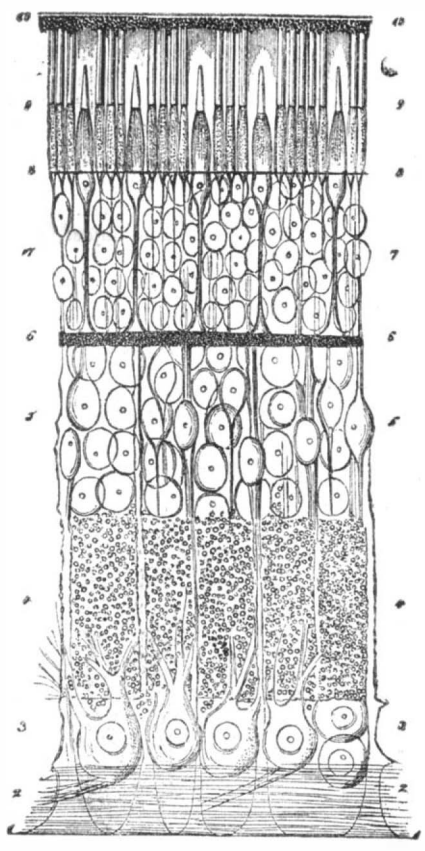
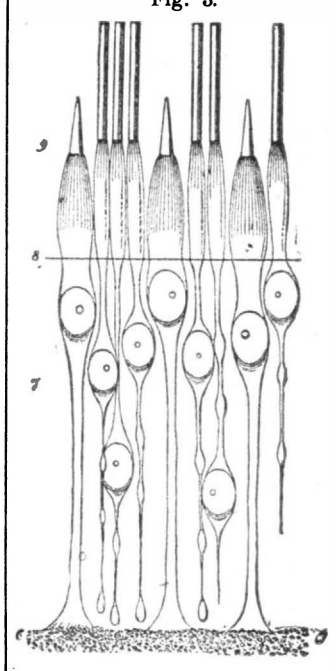


Fig. 2 shows the layers of the human retina magnified 400 times. There are no less than ten of them, all of which, with the exception of the two terminal ones, are made up of nerve tissue and connective substance. As the figure stands, the light enters from the bottom. The vibrations communicated to the nerve substance finally reach the ninth layer, where experiments, which it would take too long to describe here, have led investigators to believe that the sensation of sight is located. This layer, called the "rods and cones," from the shapes assumed by the optic nerve substance there, is supposed to be tuned to the reception of color vibrations, just as the rods of the auditory nerve are tuned to sound vibrations. Fig. 3 gives a still more enlarged view of the rods and cones, showing their peculiar structure much more plainly. Each of them is in communication with a so-called granule, forming an enlargement which contains a nucleus. In life the granules are entirely transparent. Professor Max Schultze says: "The rods and cones must be considered the nervous terminal organs of the optic nerve; in them must take place the translation of the action of light into nervous action, which process ultimately lies at the foundation of the act of vision."

Fig. 3.



On still further magnifying these curious organs, it will be seen, from Fig. 4, that even they, minute as they are, are divided into still more minute parts. What the functions of these ultimate parts are, we cannot tell; although we have reached the extreme end of the optic nerve, and have seen its wonderful complexity, we can only reason that the conversion of light into sight must take place here; but we do not seem to have approached a knowledge of *how* it is accomplished by a single step. The whole subject lies far out in the *terra incognita* of Science, and it is only intended here to state the problem as it stands at present, and to show through how tangled a jungle the path of knowledge lies in this direction.

Passing now from the anatomical considerations of the subject, we will examine the theoretical view proposed by Thomas Young, and more fully developed by Helmholtz. According to this theory, the eye perceives originally but three colors or wave lengths, and all the other colors and shades known to us arise from the compounding of the primary ones in the eye. Accordingly, we assume that the eye has three sets of nerves—one affected by red, another by green, and a third by violet. In other words, the nerve for red is tuned to vibrate to red waves of light, just as a tuning fork is set in vibration by communicating with a body sounding its note; and so with the other nerves. Each of these nerves, however, is capable of being affected, though in a much inferior degree, by colors be-

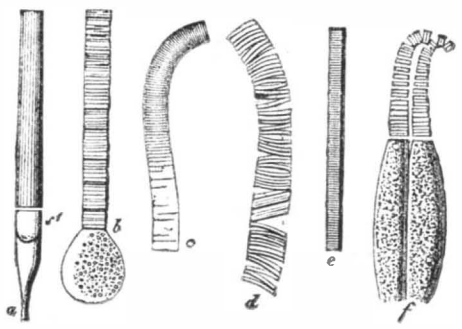


Fig. 4.*

longing to the others. Thus the red nerves would be somewhat sensitive to green waves, but would perceive them as a faint red. If, for example, we look at blue light, whose rate of vibration is intermediate between green and violet, it will affect the green and the violet nerves, producing a mixed impression, which we call blue.

Let us try and prove this. If blue is to the eye simply the result of a combined impression of green and violet, then, by exciting both the green and violet nerves by means of the corresponding colors, we ought to get a perfect impression of blue; but if the eye recognizes blue as a distinct thing, then a mixture of green and violet light will give the impression of something not identical with blue.

The lecturer then threw two disks of light on the screen, one violet and the other green; where they overlapped the result was a beautiful blue, as represented in Fig. 5.

Fig. 5.

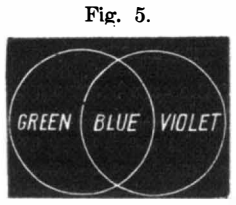
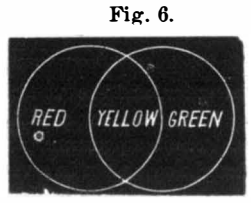


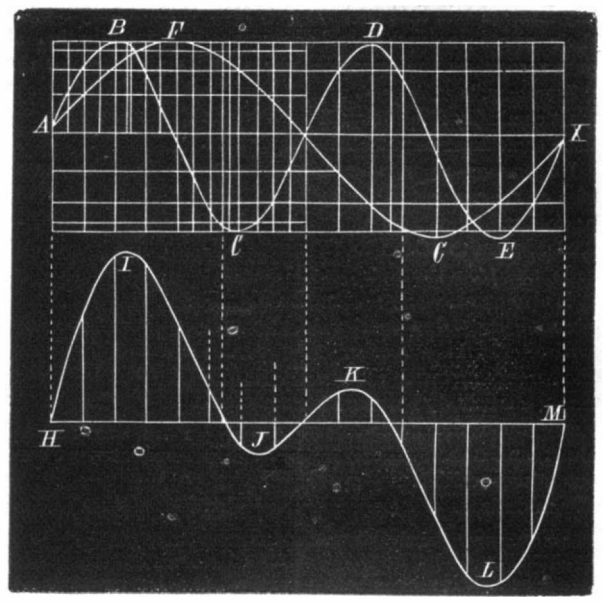
Fig. 6.



Similarly red and green disks of light, thrown on the screen, produce the compound impression we call yellow (Fig. 6).

It may be asked, however: Is not blue, being an intermediate wave length between green and violet, in fact their true average and equivalent? To show that this is not the proper manner of considering the question, it is only necessary to look at the manner in which waves combine. In the engraving, Fig. 7, we have two waves, one twice as long a- the other, and below them is their resultant, obtained as follows: Both waves, starting at A, pass up in the same direc, tion; their combined effect is therefore equal to their sum

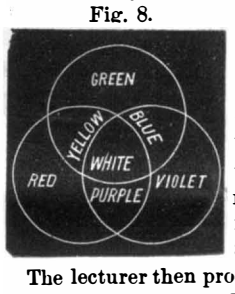
Fig. 7.



which is represented at the point, I, below; again, at the point, C, the effect of the motion of one curve below the axis, A X, is diminished by the motion of the other above the axis; the resultant point being their difference in hight, and on the same side of the axis as the greater. This point is represented at J. By combining, in like manner, all the corresponding points of the two curves, the resultant curve, given below, will be produced, and this curve certainly does not look like the average wave of the two, being, in fact, a very different kind of motion from either of its constituents.

But, to follow out the consequences of Young's theory, although white light, as we know from the prism, is composed of all colors, the eye directly perceives but three of them. Therefore if we take these three colors and present them at once to the eye, the effect ought to be white.

Fig. 8.



The lecturer then threw on the screen disks of green, red, and violet, by means of three lanterns. Where all three overlapped, the result was white; where red and green combined, the result was yellow; and where green and violet combined, the result was blue; thus satisfying the requirements of Young's theory (Fig. 8).

The lecturer then proceeded to prove these important results by other means. When an image is presented quickly to the eye and then withdrawn, the eye retains the impression for a short time after the actual image has ceased to exist on the retina. This is the phenomenon known among physicists by the name of persistence of vision. To illustrate this property, which was soon to be employed in elucidating the theory of colors, a series of dots, moving forward and back like shuttles, was thrown on the screen. As the velocity of their motion was increased, the impression made by each of them, at every part of its course, remained on the retina long enough to allow it to come around again and refresh the memory, thus seeming to describe continuous wreaths of light. A very beautiful effect was produced on the same principle by having a large revolving disk, with globes in different positions with regard to hoops painted upon it, illuminated with flashes of intermittent light produced by revolving before the source of light a disk of pasteboard with a number of slits cut radially on it. The large disk seemed to stand still and the balls to roll through the hoops with great rapidity.

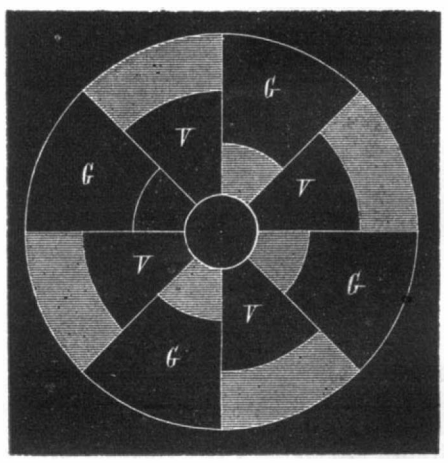


Fig. 9.

The principle of the persistence of vision may be applied to obtaining the blending of colors upon the retina, by presenting them in quick succession to the eye. Professor Rood's chromatrope is an instrument for effecting this. It consists of a disk of glass, clear at the center, opaque in the shaded parts, and colored green and violet, as indicated by the letters in Fig. 9. On revolving this disk rapidly, there was an outer zone of green and an inner zone of violet; but between them, where, by its revolution, green and violet are presented successively, the impression of green remained long enough for that of violet to combine with it in the eye and

* We are indebted to Messrs. Wm. Wood & Co. for the electrotypes of cuts Figs. 2, 3, and 4, from Stricker's great work on "Histology."

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to produce a zone of blue. Disks with other combinations of colors were also shown.

The most striking effect of the lecture, however, was produced by means of a very ingenious invention of Professor Morton. He calls it the "chameleon top," and its construction is well worth studying. An opaque disk, with W (Fig. 10) for a center, is made to revolve before a lantern by means of the large pulleys, M and P. It has no axle, but is in friction gearing with the little pulleys, *x x x*. In this opaque disk, there is a transparent one, W R B, composed of segments of white, red, and blue glass, as shown in the engraving. The transparent disk, moreover, is set in the other one loosely, so that its motion may be suddenly checked by means of an elastic pad, E P, while the large disk is in full revolution. By this means the center is shifted from one color to another. Now let us see the result of that. When the instrument is at rest, nothing appears upon the screen, except a very unpromising disk divided into three portions. But the moment it begins to revolve, the colors blend in various ways, forming rings of ever changing hues, which succeed each other like those of the most gorgeous pinwheels of pyrotechnics. Suppose the disk revolves with its center in the white, then the blending of colors in each zone can be studied from the circles of Fig. 11; Fig. 12 represents the

Fig. 10.

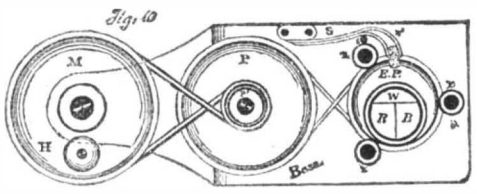


Fig. 11.

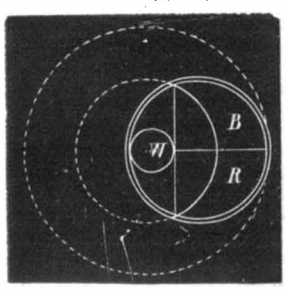
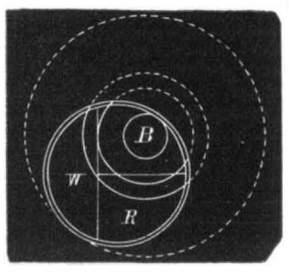
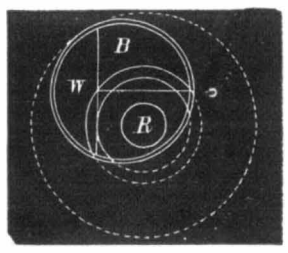


Fig. 12.



effect when the center is changed to blue, and Fig. 13, when it is shifted into the red. The dotted portions of the zones are those seen by persistence of vision. Now, by means of rapidly pressing the elastic pad against the projecting rim of the transparent disk, there is a constant shifting of centers, and the result is an infinite variety of splendid effects.

Fig. 13.



There is still another way of proving the theory of color. By throwing on the screen the intense light obtained by burning mercury, and by burning steel in the electric arch, the eye does not distinguish them; but by passing these lights through a prism, they are proved to contain very different elements. In fact, it would be all the same to the eye, if only the three primary colors existed and no others, for the result would be the same; when combined they would form white light.

Now, how do we know that the primary colors are red, green and violet, and not red, yellow, and blue, as we were taught years ago, and as Sir David Brewster maintained? An experiment will answer this question. If red, yellow, and blue are the primary colors, then green must be a mixture of yellow and blue. According to Young's theory, however, yellow and blue are equivalent to white; because by them we excite all the nerves, yellow being equal to red and green, and blue being equal to green and violet. If Brewster is right, blue and yellow light will make green; if Young is right, they will make white. The lecturer then threw the two colors from two lanterns on the screen by means of colored glasses. The result was white. The same result was obtained with the chromatrope.

How does it come, then, that blue and yellow paints mixed produce green, as every child knows?

The color of paints is due to the light passing through them to the paper and reflected from the paper under them. Now, white light passing through blue paint is robbed of every color except blue, green and violet; passing through yellow paint, it is robbed of all but yellow, red, orange, and green. Green, therefore, is evidently the only color that both are agreed in transmitting through them. The same effect is produced by taking the very glasses, blue and yellow, whose combination just produced white, and allowing the same white light to pass through both, instead of having separate sources of light. The result is green, because the combined glasses cut off every other color.

There is another property of the eye with regard to the perception of color, which must not be overlooked. Like all other organs of the body, the eye is easily fatigued. If we look at red light for a long time, the nerves vibrating with it become so tired that they cease to act; if now the red is suddenly withdrawn and white substituted, the other two sets of nerves, namely, the green and violet, either act alone or are but faintly seconded by the red; and the consequence is we do not see white at all, but a shade of green. This was strikingly shown by an experiment. Two lanterns, side by side, threw on the screen, one pure white light, and the other red. After the audience had looked at it awhile, Professor Morton placed himself in such a position as to cast two shadows on the screen; one of them was red, of course, but where only white light fell the shadow was blue green. On substituting green light for the red, the shadow falling on the white part of the screen looked red. This is the principle of contrast in color, which many an artist has no doubt carried out in practice without suspecting the cause. As an illustration of a well known enect of contrast, the Professor threw on the screen a piece of statuary, and then gave it a background of green foliage by means of another lantern, the effect of which was to endue the statue with a warm tint of red.

In conclusion, the lecturer remarked that he did not wish to convey a false impression when speaking of certain imperfections of the eye. "Helmholtz, one of the most eminent physicists of the day, has used an expression with reference to the subject, which, when quoted alone, without the general spirit of the context, might convey the idea that he considers the eye as a bungling piece of workmanship unworthy of any skillful optician. Any candid reader who peruses the whole article will find that this is as far from the meaning of the author as it is from the fact. Discrimination between wave lengths is not only not the true office of the eye, but would be quite inconsistent with its varied and indispensable functions as an organ of vision. It is perfectly true that the eye, as a spectroscope, is a very poor instrument; but who, when gazing at the glories of a crimson sunset, at the beauties of a variegated landscape, or the blended roses and lilies of a pretty face, would exchange his eyes for a pair of the finest spectroscopes that ever left the shop of the most skillful physicist?" C.F.K.

How American Workmen Live.

A recent annual report of the Massachusetts Bureau of Statistics contains some interesting facts touching the wages and manner of living of working people in that State. It may be assumed we think, that in no State of the American Union is the average situation of the working man any better, but, if any different, will be found rather below than above that of Massachusetts.

The statistics, upon which the facts given are based, were gathered by personal visits of the Bureau officers in all parts State, and were obtained from the workmen in all branches of skilled and unskilled labor. Complete returns were obtained from 397 families, and the condition of this number is presented in detail, as shown in the following example:

CARPENTER.

Annual earnings of father (American), $760, being an average of $2.43 cents per diem, paper currency.

Condition: Family numbers five, parents and three children from three to ten years of age; two go to school. Have a tenement of five rooms located in a good neighborhood with pleasant surroundings. The rooms are well furnished and the parlor carpeted. Have a sewing machine. The family dresses well.

Food: Breakfast, hot biscuit, butter, meat or eggs, cake and tea; dinner, bread, butter, meat, potatoes, vegetables, pie; supper, bread, butter, sauce, cake, and tea.

Rent	$132.00	Fish	$10.00
Fuel	37.00	Milk	17.90
Groceries	346.22	Boots and shoes.	26.30
Meat	80.50	Clothing	50.00
Dry goods	19.84	Religion	10.00
Papers	8.00	Sundries	13.24
Cost of living			760

All of the statements are presented with this same detail, and give a picture of the home economies of the State that is both interesting and instructive to all wage laborers. By these statements it is shown that five families out of 397 invested in furniture and carpets; 264 families, or 66+ per cent of the whole number, expended an average of $9 yearly for books and newspapers; 34 per cent paid society dues, and the same percentage devoted money to religion. Of the 397 families, 11+ per cent have pianos or cabinet organs; 34+ per cent have sewing machines, and, in addition to this labor-saving article, many possessed wringing machines, as will be found by reference to the family statements; 52+ per cent had one or more carpeted rooms, in many instances, as stated in the individual presentations, the entire tenement of five or six apartments being carpeted; 26+ per cent paid rates for church pews.

Of the 142 families in which the father was the only worker, the average income was $723.82. Of the 255 families in which the wives or children assisted, the average income was $784.38. The average income of the families of skilled laborers (including overseers) was $823 60, while of unskilled laborers' families $687.05 formed the average income; and of the total expenditure of the 397 families, 58 per cent was required for subsistence, 14 per cent for clothing, 16 per cent for rent, 6 per cent for fuel, and the balance of 6 per cent was devoted to sundry expenses.

From the statements and tabulated returns, the Bureau has drawn the following conclusions:

As regards earnings: That in the majority of cases working men in the Commonwealth do not support their families by their individual earnings alone; that the amount of earnings contributed by wives, generally speaking, is so small that they would save more by staying at home than they gain by outside labor; that fathers rely, or are forced to depend, upon their children for from one fourth to one third of the entire family earnings; that children under 15 years of age supply, by their labor, from one eight to one sixth of the total family earnings.

As regards expenses: That, judging from the proportionate outlay for dress, as regards entire expenses, there is no evidence that the working men we visited, in obedience to fashion, indulge in an excessive or disproportionate expenditure; that, from our investigations, we find no evidence or indication that working men spend large sums of money extravagantly or for bad habits: that, as regards subsistence, rents, and fuel, the working men's families which we visited paid therefor larger percentages of their income than do working men's families, with like incomes, in Prussia and other European countries; and that, as regards clothing and sundry expenses, our working men's families paid therefor smaller percentages of their income than do working men's families, with like incomes, in the countries mentioned above.

As regards manner of living: That, among the families visited, those containing the greatest number of child workers occupy the most crowded rooms and the inferior class of tenements; that about three quarters of the working men's homes which we visited are in good condition as regards locality and needful sanitary provisions, but that nearly one half of the unskilled laborers live in the inferior tenements; that the working classes of Massachusetts, judging from our investigations, are well fed; that, as far as our investigations extended, our working men are, on the average, well and comfortably clothed; that their manner of dress is, at least, capable of most favorable comparison with that in foreign countries; that a large proportion of the skilled working men visited have sewing and other labor-saving machines in use in their families; and that, as evidences of material prosperity to a certain extent, significant numbers of the families, the aid of child labor being fully allowed, own pianos or cabinet organs, have carpeted rooms, and maintain pews in church.

As regards savings: That more than one half of the families visited save money; less than one tenth are in debt, and the remainder make both ends meet; that without children's assistance, other things remaining equal, the majority of these families would be in poverty or debt; that savings, by families and fathers alone, are made in every branch of occupation investigated; but that in only a few cases is there evidence of the possibility of acquiring a competence, and in those cases it would be the result of assisted or family labor; that the higher the income, generally speaking, the greater the saving, actually and proportionately; that the average saving is about three per cent of the earnings, and that, while the houses of the working men visited compare most favorably with those in foreign countries and other States of the Union, yet in certain of the United States working men have better opportunities for acquiring homes of their own.

From these conclusions, it is asserted that, while the wage system enables a minority of the working men to maintain themselves and families comfortably by their individual exertions, in a majority of cases they have to have aid from wife or children to accomplish this result.

Pneumatic Railway Signals.

At Wilmington, Del., the Philadelphia, Wilmington and Baltimore Railroad Company has recently put down, on trial, a new railway signal and gate system. Along or between the tracks, or under the road, a pipe is laid, 2 inches in diameter, in which compressed air, 85 lbs. to the inch pressure, is carried. When the train moves out of the depot, the locomotive strikes a lever; and at the first street which the track crosses, a gong or bell is set ringing, to warn persons that a train is approaching, and a gate extending across the street descends to within two feet of the ground. The gate remains closed until the train has passed. The locomotive then strikes another lever, when another bell is rung, and another gate a square ahead is closed; and the gate behind the train is caused to rise to its place, and that crossing is left free. In this manner every train that passes through a city is made automatically to fence itself in, as it were, by closing and opening gates over each street, one or two squares in advance as may be desired.

When the train starts, by its striking the lever already described, a danger signal is instantly thrown around at right angles to the track behind the train, and another a mile ahead of it. When this one is reached another lever is struck, and the last mentioned signals are thrown back to their former positions, showing the first mile to be clear; and the two other signals, one behind and one a mile ahead of the train, are exposed, and so from mile to mile along the whole road. At every point of its progress a train is thus between two signals, one to warn trains coming toward it, the other to warn trains following it.

The Way to Get Along.

Twenty clerks in a store, twenty hands in a printing office twenty apprentices in a shipyard, twenty young men in a village—all want to get along in the world, and expect to do so. One of the clerks will become a partner, and make a fortune; one of the compositors will own a newspaper, and become an influential citizen; one of the apprentices will become a master builder; one of the young villagers will get a handsome farm, and live like a patriarch—but which one is the lucky individual? Lucky? There is no luck about it. The thing is almost as certain as the rule of three. The young fellow who will distance his competitors is he who masters his business, who preserves his integrity, who lives cleanly and purely, who devotes his leisure to the acquisition of knowledge, who gains friends by deserving them, and who saves spare money. There are some ways to fortune shorter than this old, dusty highway; but the staunch men of the community, the men who achieve something really worth having, good fortune, good name, and serene old age, all go in this hard, dirty road.—*Exchange.*

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DECISIONS OF THE COURTS.

Supreme Court of the United States.

In equity.—Appeal from the Circuit Court of the United States for the Southern District of Ohio.—October Term, 1874.]

HENRY J. REEDY, APPELLANT, *vs.* GEORGE SCOTT.

Mr. Justice Clifford delivered the opinion of the court:

The surrender of a patent to the Commissioner is an act which, in judgment of law, extinguishes it. It is a legal cancellation of it; and hence the patent can no more be the foundation for the assertion of a right, after the surrender, than could an act of Congress which has been repealed; and it has frequently been determined that suits pending which rest upon an act of Congress fall with the repeal of it. Antecedent suits depend upon the patent existing at the time they were commenced, and unless it exists and is in force at the time of the trial and judgment, the suits fail.

Where a suit in equity under a patent is pending at the time of the reissue, a supplemental bill setting up the reissued patent is not a proper pleading to revive such a suit, as nothing can be recovered, either as damages or profits, for the infringement of the surrendered patent.

The infringement of the reissued patent becomes a new cause of action, for which, in the absence of any agreement or implied acquiescence of the respondent, no remedy can be had except by the commencement of a new suit.

But where the complainant, having reissued his patent pending a suit, set up this fact in a supplemental bill, all the proofs in the case being taken thereafter, and neither the respondent nor the court below made any objection to the irregularity of the pleadings, the irregularity was also disregarded by the court on appeal.

Where the defence against a reissued patent is that it is for a different invention from the original, it cannot be doubted that the latter may be the subject of reference, as to a repealed statute, to aid in the construction of the new patent issued upon the corrected specification.

[*George E. Pugh* for appellant.

No counsel appeared for respondent.]

Recent American and Foreign Patents.

Improved Electro-Magnet.

Mark A. Rice, Pentwater, Mich.—This invention consists of making a number of electro-magnets with one coil, by introducing any part of each of several bars into a coil of insulated wire while other portions are outside of the coil. One leg of each of several U-shaped bars will be in the coil, and the other legs out along the exterior, or the wire may be coiled around the parts which connect the legs, leaving the two legs out, so that they project radially from the ends of the coil. By this plan each magnet is obtained nearly as strong as it would be if the others were not inclosed, and a much greater magnetic force from a given coil or given force, with less battery, power is produced.

Improved Apparatus for Cutting Goods on Bias.

Salomon Mayer, New York city.—This invention consists of a table with one or more knife-grinding bias slots, in connection with an adjustable treadle-acted clamp piece and adjustable gage pieces, which are set to the required width and angle of the bias strips, for cutting a suitable number of layers at the same time.

Improved Medicated Beer.

Robert W. Tavenner, Bay City, Mich.—The invention consists in a novel method of preparing beer so as to deprive it of its intoxicating property, while its tonic and curative character is preserved in its integrity. It is thus made especially soothing to the nervous system, toning it up and eradicating neuralgic tendencies, while the blood is gradually purified and enabled to perform its normal functions with regularity and efficiency.

Improved Method of Bleaching Cane Juice.

John M. Lescale, Paincourtville, La.—This invention relates to certain improvements in apparatus for bleaching sugar cane juice, and it consists in a vertical box or tank divided into compartments by means of shelves, in combination with a vertical revolving shaft provided with spirally arranged wings revolving in said compartments and alternating with the shelves. The juice is admitted to the tank from the top, and, falling upon the revolving wings, is dispersed by centrifugal force in the form of a spray through the decolorizing sulphurous acid with which the tank is filled; and being collected upon the sides of the tank and top of the first shelf, it trickles to a central opening in said shelf, and drops upon the revolving wings in the second compartment for a repetition of the dispersing process. Any number of compartments with the shelves and alternating revolving wings can be used that may be desirable to wholly decolorize the juice. The spiral arrangement of the wings upon the revolving shaft induces a current of sulphurous acid from the generator, and the said gas is forced directly upward through the falling spray of the juice, thereby securing the most thorough impregnation of the juice with the gas, and consequently the most perfect bleaching.

Improved Door Check.

D. Gundelfinger, Jefferson City, Mo.—The invention relates to the means patented by the above, October 13, 1874, to prevent the door knob from striking the wall paper, and consists in a novel construction of the slide and case, and in placing an adjustable stop over the short arm of the lever.

Improved Shoe Brush.

Andrew McElrath, 191 Duane Street, New York city.—This is a blacking brush provided with circular cavities, connected by a groove, to receive the implements required in the operation of polishing boots or shoes. A lid or cover is secured to the back of the brush by hinges, and, when closed, by a locking catch and spring. The back is provided at its respective ends with deep circular cavities, to receive and hold the wetting brush and blacking box, the handle of the former resting in the groove joining said cavities. A shoe horn is placed beneath the box, and its handle, which has a cleaning brush, also projects into the same groove. A groove is also formed on each side of said central groove, one to receive a button hook, the other a cleaning tool. A plush hat brush is applied to the outer side, and a mirror to the inner side of the lid.

Improved Railroad Signal.

Colonel Robert L. Kilpatrick, Springfield, O.—The invention consists in the use of a double treadle with clutch mechanism, so that the bell is struck or other alarm given simultaneously with the display of the signal whenever a train is approaching the station. When, however, the train is going from the station, the treadle is rendered automatically inoperative.

Improved Combined Potato Digger and Cultivator.

Henry W. King, Canaan, N. Y.—This invention relates to certain improvements in potato diggers, and it consists in the combination of a series of S-shaped revolving digging fingers, with a second series of clearing fingers, and a pivoted inclined shaker table consisting of slats: the said digging fingers lifting the potatoes and dirt from the hill, and the clearing fingers passing between the diggers and transferring the potatoes and disintegrated clods to the inclined table, which, being agitated by the unevenness of the ground, allows the dirt to pass through the slats and the potatoes to be delivered at the rear of the table. It also consists in the peculiar construction of the digging and clearing fingers, and in the devices for throwing the operating mechanism in and out of gear.

Improved Boot and Shoe.

Wm. Myer and Henry Freiburg, Quincy, Ill.—This invention relates to certain improvements in boots and shoes, and it consists in a wooden heel and shank whose upper surface forms a part of the bottom of the shoe, the upper and counter being attached to the outer surface of the shank, and in a groove around the heel, and the whole secured and combined with an outer sole which extends the whole length of the shoe and covers both the sole and shank. The said outer sole extends also around the groove in the heel to protect the edge of the counter, and, while adding to the strength of the shoe, adapts the same to receive a superior finish.

Improved Awl.

Sylvester A. Smith, Muscatine, Iowa.—The invention consists in a shoemaker's awl so constructed as to render entirely unnecessary the bristle usually employed on one end of the waxed thread. This is accomplished by making notches in the awl near the end, said notches being reversely inclined.

Improved Revolving Fly Brush.

John Gilliford and John M. Hoffman, Spruce Hill, Pa.—This invention relates to certain improvements in fly brushes. It consists in a clock spring and spur gear contained within a suitable case, which may be mounted upon legs or a pedestal, according to the character of the work to be performed, the said gearing meshing with a pinion upon a vertical shaft journaled in bearings in the casing. A vertically adjustable sleeve of peculiar construction revolves with the vertical revolving shaft, and is held in position by a locking stud that engages with notches in the said shaft. In said sleeve are detachably fastened radial arms of peculiar construction which carry brushes that, in revolving, act as a noiseless escapement for the clock gearing; and the revolving shaft is provided with a binding screw and spring, which operate as a brake to regulate the speed of the brushes.

Improved Bath Tub.

Asa C. Brownell, Brooklyn, N. Y.—This invention relates to certain improvements in bath tubs; and it consists in the peculiar arrangement of parts whereby is constructed a combined plunge and sitz or foot bath in one and the same frame; and it further consists in the combination with the two compartments of the tub of a single overflow pipe.

Improved Ice Pitcher.

Louis Evans, Pittsburgh, Pa.—This invention relates to certain improvements in ice pitchers; and it consists in the combination with the pitcher of an inner casing to contain ice, having a detachable perforated cup in the bottom thereof, containing filtering material which eliminates the dregs and sediment from the ice, and leaves the water to be used perfectly pure and clean.

Improved Magazine Fire Arm.

Reuben S. Chaffee, Springfield, Ill.—This invention consists of a hollow metal stock, in which revolves on journals the magazine containing tubes, in each of which is contained a cartridge driver, which is held in position by notched openings in the tubes. At the back end of the magazine are pins, corresponding in number to the tubes, for revolving the magazine. Below the magazine lies the loading bar, on which are ranged lugs, for carrying the cartridge drivers forward. At the back end of the loading bar is a stop plate, in which is a spring cam. These, with the pins, both permit and stop the revolving of the magazine. A hook on the loading bar communicates with the breech block, and imparts its motion to the loading bar. On the under side of the gun is the breech block, to the front of which is attached a finger to hold the cartridge in position as it is moved forward. Above this, in a closed space in front of the magazine, is the cut-off, with spring, for forcing the cartridge forward of the breech block.

Improved Cotton Cleaner.

George W. McCauley, Pleasant Plains, Ark., and Wm. L. Crowson, Memphis, Tenn.—The invention consists in the improvement of cotton cleaners by combining with a thresher a suction fan, so arranged as to draw air in at one part of the machine, take all the dust and light impurities from the cotton as it is thrashed, and discharge it on the outside of the gin house.

Improved Table Slide.

James O. Frost, Towanda, Pa.—This invention relates to certain improvements in extension table slides, and it consists in a plate having hook-shaped extremities which grasp the frame pieces, an extension or tongue in between the hooks, which moves in a groove in the frame pieces, and a dovetail extension upon the outside, which forms a rigid connection for the plate to the frame pieces without the use of screws.

Improved Wagon End Gate.

Samuel C. Myers, Pana, Ill.—This invention consists of an end gate, which is attached to the body by a lateral spring bar with end catches that lock into a recess of the side board, and a recess of an outer gate hinged to the opposite side board. The end gate is quickly taken off by pressing the spring catch back and swinging the side gate into open position, which allows the ready detaching of the end gate from the opposite side board.

Improved Revolving Rack for Holding Stockings.

Daniel K. Wertman, Shenandoah, Pa.—This is an improved device for suspending socks, stockings, or other goods from a revolving rack, which revolves on an iron pin in the base, and stands on the counter, or in any suitable position, for exhibiting the goods.

Improved Brick Machine.

Edward Deshler, Allentown, Pa.—This machine is made double, or to turn out brick from each side, the grinding and tempering mills and the brick molds being duplicates of each other. The parts of the machine are supported by a properly constructed frame, in the two end portions of which frame the clay is ground, elevated, and tempered, and delivered into the pressing cylinder, which latter is supported by the central frame. A bar scrapes the bricks from the ends of the plungers as the mold recedes, and leaves them on the brick board. The plungers are carried back and forth by the mold plate, and form the bottoms of the molds when the clay is pressed into them.

Improved Mill Spindle.

William Elliot, Williamsford, Canada.—This is an improved device for suspending the millstone above the water wheel shaft without raising and lowering the wheel with it, so that the adjustment of the upper stone to the exact position required for grinding it may be readily accomplished, and a perfectly horizontal position and smoother running of the stones obtained.

Improved Dental Plate.

Jonathan N. Clark, Bradford, Vt.—This consists of a wedge-shaped rim of soft rubber on the inner edge of the plate, forming a cushion against the gum while preserving a perfect vacuum.

Improved Cultivator.

Perry F. Landphere, Mazon, (Morris P. O.,) Ill., assignor to himself and Deloss Jones, same place.—This cultivator cultivates two rows at a time, and can be readily adjusted to cultivate a single row, or may be used as one or two single row cultivators.

Improved Lamp Burner.

James Curzon, Darien, Conn.—The flat wick tubes are arranged at the base in two parallel planes, so that the wick may be raised and lowered by straight parallel ratchets. The tubes twist from the ratchets upward to the top, so that they are radial to a common center thereat, and thus expose both the wide sides of all the flames to view. The filling tube is provided with a spring-closing valve, to be opened by pressure on it by the nozzle of the can, and to close self-actingly when the nozzle is taken away.

Improved Organ-Stop Action.

Frederick M. Brush, Potsdam, N. Y.—The stops are arranged to be pushed out or pulled in by hand, in the usual way, and, besides, are provided with a lug on two sides, to be acted on by the arms of the shaft to be pushed in, and by the arms of the shaft to be pushed out. The pedal may be arranged to be worked by the feet, hands, or knees, as preferred.

Improved Adjustable Reclining Lounge.

Emil Bartels, New York city.—By means of this invention, the head of a sofa or lounge may be easily and quickly adjusted to any desired inclination; and, when fixed, the same is held securely in place.

Improved Green Corn Cutter.

William J. Potter, Mount Lebanon, N. Y., assignor to himself and Robert M. Wagen, same place.—Each pair of knives is attached to an adjustable frame, and the frames are placed at right angles with each other. The two knives of each pair form an oval opening. These openings are placed at any angle with each other which will allow the knives to cut all the corn from the cob. The knives are gaged to split the kernels; the first pair cut less than the next, while the last pair cut the kernels clean from the cob, and the cob is forced out through the opening at the end of the machines. The inner ends of a plunger and rod are made concave, to enable them them to embrace the butt of the ear. The ears of corn are fed in by hand, one or more at a time, and every stroke of the plunger cleans the corn from the cob and divides the kernels into two or more pieces, according as the knives may be graduated.

Improved Skate.

Reginald H. Earle, St. John, Newfoundland.—This invention simplifies the construction of the skate for which letters patent were granted to the same inventor, September 15, 1874, to enable it to be applied to any kind of a boot or shoe. By turning the screws, arms may be moved out and in, to adjust them to the width of the boot sole to which the skate is to be attached; and by moving a plate forward the arms will be moved inward, to clasp the edges of the boot sole and secure the skate to it. By moving the long arm of a lever outward, the sliding plate is moved forward, which releases the skate from the boot; and by moving the long arm of the said lever inward, the sliding plate is moved to the rearward, clamping the skate to the boot.

Improved Dumping Car.

Robert Roberts, Pattenburg, assignor of one half his right to Nathan S. Wyckoff, Clinton, N. J.—To the frame is attached a block, upon which the forward end of the car body rests, and to which it is secured while being filled and moved. The body of the car, a little in the rear of its center, is attached to a cross plate, to the under side of which are attached lugs in which work journals on a cross head of a bolt. The bolt passes down through a hole in the center of a washer and in the center of the circular recess in a plate, and through a tubular projection formed upon the lower side of the plate. The car body is turned when it is desired to dump the load at the side of the car and a guard block keeps the said car body steady while being turned. The tail board is secured, when closed, by a drop bolt, which slides up and down in keepers attached to said tail board, and is pivoted to a lever which is pivoted to the tail board. The free end of the lever raises the bolt and unfastens the tail board, when it will be pushed out of the way by the load as it slides from the car body. The tail board may be raised out of the way, for convenience in loading the car, by swinging it either inward or outward into a horizontal position, and then sliding the upper arms of U straps along the suspending keepers.

Improved Gas Engine.

Pedro Vera, Bogota, United States of Colombia.—This is a hollow cylinder, hermetically closed, having pipes connecting it with pumps for introducing air, and a pipe for exhausting it, and containing a strong hollow gun cylinder, divided at the middle by a strong partition and open at each end, the partition having a hole through its center through which a long piston rod carrying a disk, so arranged that the ends of said gun cylinder will be alternately closed and opened as it moves forward and back. The apparatus being arranged, a certain quantity of mixed hydrogen and oxygen gases, in the proportion of two atoms of the former and one of the latter—the quantities for forming water—will flow into one of the gun chambers. At the same time, a current of electricity will be caused to enter the gun chamber, into which the gas flows, by the wire of said chamber being brought into contact with the wire of an electric machine to ignite and explode the mixture by a spark, and form water. By the heat generated in the chemical action, the the water produced will be instantaneously converted into steam, which will force the piston from the gun chamber last exploded, so as to change the valves and the wire connections, and cause the action to be repeated in the other chamber, and so on. At each stroke of the piston a quantity of air will be introduced into the cylinder by the pumps, which will be heated by the heat evolved by the chemical action and expanded so that it can be utilized as a motive power, being conducted to the engine.

Improved Car Coupling.

William Green, Hyde, England.—Two laterally swinging hooks are supported by rear springs and pivoted on pins attached to the cars. To the pivoted pins is attached a lever by intervening rods. A pin holds the rod rigidly to the hook. An automatic spring coupling is thus produced, which may be uncoupled by one of the levers.

Improved Compress.

Auguste A. Lelièvre, Chatou, near Paris, France.—This consists in arranging between two wadding sheets a layer of mucilage made of Irish moss. The whole is, by desiccation, transformed into a sort of pasteboard, which can be cut out by means of scissors into square, rectangular, or other bands. This compress is liable to readily be softened by water being applied thereto, and yet preserve its mucilage. It can be used as an advantageous substitute for the poultice, the compress linen and binding bands being employed as usual.

Improved Needle Book.

Frederick Swan, New York city.—This is a book-like case, the covers of which are covered inside with cloth suitable for sticking the needles, and padded. The cloth is divided into sections for the different sizes and styles of needles, and numbered accordingly, with a partition to prevent the needles of one side from interlocking with those of the other.

Improved Sectional Bucket Pump.

George W. Burr, East Line, N.Y.—This consists of a bucket made in sections, which are so constructed that they pack tightly together when the bucket is raised, and loosen or contract when it is lowered, the same being connected with the plunger rod by means of a cup.

Improved Egg Beater.

Martin Cline, Chicago, Ill., assignor to himself and William J. Cline, same place.—To the cylinder and piston, ordinarily used with a perforated bottom for egg beating, the inventor adds a downwardly-tapering nozzle, downwardly-decreasing reticulated diaphragms, and a rest having bottom notches. By this improved construction, the accidental dislocation of the diaphragms is prevented, and the beater held firmly against the bottom of the dish into which the eggs are broken, while egg substance is more gradually drawn up and less crowded in its passage upward.

Improved Clothes Pin.

Otis F. Porter, Bridgeport, Conn.—This clothes pin is of two parallel strips, having a bevel at each end, an intermediate elastic block, and an embracing wire around strips and block. The wire and block have sufficient elasticity to allow the strips to separate and then clamp the clothes line.

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Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Sewing Machine Needles—12 for 50c., any sizes, any machine, best quality. Geo. P. Bent, Chicago, Ill.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

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Models for Inventors.—H. B. Morris, Ithaca, N.Y

A Situation Wanted by an Engineer of Stationary Engine. Address H. Williams, East Arlington, Vt.

Wanted—Priced Catalogues of Iron Fountains, Statues, &c. E. L. Ransome, 10 Bush St., San Francisco.

The Philadelphia "Sunday School Times" says of Geo. P. Rowell & Co., of New York: "They are the most enterprising, prompt, systematic and reliable Advertising Agents with whom we are acquainted. We have had some most satisfactory dealings with them in some extensive advertising plans in our business,"

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For Sale—The entire Patent or State Rights for the best Boiler Flue Cleaner in use. Address Jacob Armbruster, Petroleum Center, Pa.

Best Silk and Cotton Magnet Wires. Frank S. Mead & Co., Providence, R. I.

M'f'rs of small, profitable, saleable, patented goods, needing pecuniary assistance and a driving general agent, please address E. E. Roberts, 119 Liberty St., N.Y.

Wanted to hire, for six months, with privilege of purchase, a small Iron Planer, 4 or 5 ft. bed. Henry Whitney, Box 97, Rahway, N. J.

Gilman Sample Vial, with Scales, $12; without, $10 per Gross. Agents wanted. R. d'Heureuse, P. O. Box 395, New York.

Mechanics, send immediately for a set of tables you cannot do without. Price 25 cents. E. B. Knight, Manayunk, Philadelphia Co., Pa.

Wanted—Foreman in an Agricultural Machine Shop. Reference required. Address Harris Manufacturing Company, Janesville, Wis.

English Sparrows Wanted. Send prices to H. C. Draper, Oswego, Kan.

For the Original Skinner Portable Engine (improved), 2 to 8 H.P., address L. G. Skinner, Erie, Pa., late Skinner & Walrath, Chittenango, N. Y.

Stamps for Live Young Men—The American Burglar Proof Key Fastener. Send 25c. for Sample. C. E. Dayton & Co., Meriden, Conn.

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Every MetalWorker should have a Universal Hand Planer. Address J. E. Suitterlin, 60 Duane St., New York.

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A Rich Gold Mine Discovered for Agents Selling very desirable new Patent Articles for housekeepers and others. G. J. Capewell, Cheshire, Conn.

English Agency.—A gentleman, with best connections in England and highest references here, would undertake to represent a company or firm manufacturing goods suitable for the British markets. Those willing to offer liberal inducements may address Agency, care "Scientific American," 37 Park Row, New York.

For Sale—A new patent for a Cross-Cutting Machine, the best in the market. Can be seen in operation 124 Goerck St., New York. Inquire for Geo. Marshall.

For Sale—A lucrative patent on Christmas Tree Candle Holders. Address Wm. Ulrich, 49 Montgomery Street, Newark, N. J.

Soap Stone Packing in large or small quantities. Walrus Leather Wheels for polishing any Metals. Belt Studs for fastening Leather or Rubber Belts. Baxter Wrenches for difficult corners. Greene, Tweed & Co., 18 Park Place, New York.

Three Second Hand Norris Locomotives, 16 tuns each; 4 ft. 8½ inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

For Sale—Factory. Two Stories, 36x80—Engine and Boiler, 40 horse power—Shafting, Steam Dry House, Sheds, etc. Lot, 340x220 ft.. Good chance for manufacture of cheap furniture or agricultural implements. Hardwood lumber in abundance and cheap. Address, for particulars, Sayer & Co., Meadville, Pa.

Agents.—100 men wanted; $10 daily, or salary. selling our new goods. Novelty Co., 300 Broadway, N.Y,

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure Boiler, as it has no effect on iron; saves 20 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., ½ Bbls. 250 lb., ¼ Bbls. 125 lb.. Price 10 cents per lb., less than ¼ price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

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Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

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The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

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Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

The Baxter Steam Engine, 2 to 15 Horse Power. Simple, Safe, Durable, and Economical. "The Best are always the Cheapest." Over One Thousand in use, giving entire satisfaction. Address Wm. D. Russell, 18 Park Place, New York.

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Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N.Y.

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Genuine Concord Axles—Brown, Fisherville, N.H

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Temples and Oilcans. Draper, Hopedale, Mass.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Notes & Queries

T. C. W. should consult a physician.—G. S. W. will find a recipe for paste that will not sour on p. 219, vol. 30.—L. S. will find a recipe for French polish on p. 11, vol. 32.—H. H. can tin cast iron by the process described on p. 362, vol. 31.—H. V. will find full directions for tempering steel in the early chapters of "Practical Mechanism," and for constructing a small furnace on p. 235, vol. 32.—G. W. P. will find directions for making a battery for plating on p. 202, vol. 32. A good alloy for castings is described on p. 104, vol. 24.—W. M. will find a description of water filter on p. 251, vol. 31.—J. D. will find directions for hardening tallow on p. 201, vol. 24.

(1) J. E. J. says: 1. Please explain the following: "A round hole, the size of the lens, was made in each, the meniscus being contracted to ¾ inch, and the eye glass to ¼ inch diameter." A. If a lens is bad, the edge zones are cut off by a stop or diaphragm. 2. What would be the power of a telescope made as directed, with a meniscus object glass of 1 inch diameter and 48 inches focus, with an eyepiece (plano-convex) of 1 inch focus? A. Forty-eight. 3. Which would be better, the above, or an achromatic object glass of 2 inches diameter and 30 inches focus, with a plano-convex eyepiece of 1 inch focus? A. The achromatic.

(2) J. E. J. asks: What will be the power of a telescope with an achromatic object glass of 2 inches diameter and 36 inches focus, and a plano-convex eyepiece of 1 inch diameter and 2 inches focus? I wish to make the best telescope of which the cost shall not exceed $10. The above lenses will cost $8 or $9; are they as good as I can expect for the money? A. Yes. Power, 18. See previous answers for construction of eyepieces.

(3) W. A. asks: At what distance will the most powerful telescopes observe any moving object? A. Under the most favorable circumstances, about 190 times as far as it can be seen without the aid of an instrument.

(4) W. S. H. says: I wish to make a telescope of sufficient power to view objects 1 or 2 miles off. Will the following glasses do? Object glass of 3 inches diameter, 20 inches focus, achromatic; 3 double convex lenses, 1 inch in diameter, set 1½ inches apart, constituting the eyepiece. A. This is a bad form of telescope. The objective is of too short focus for the aperture, and the erecting eyepiece performs better with 4 lenses than with 3. See No. 48, September 26, 1874, and consult our optical answers for a year or two back.

(5) T. & Co. ask: We have a large lens, diameter 3½ inches. It is scratched, and needs repolishing. How can we do it? A. The scratches on your camera lenses will very slightly lengthen the necessary exposure. It would not pay to repolish them.

(6) R. H. S. says: 1. Please say what particular advantages there are in periscopic spectacles over plano-concave for near-sightedness? A. The periscopic give a larger field of view. 2. What is polarized light? A. Light waves split in two so that one ray vibrates in one plane and the other in a plane at right angles thereto. This is effected by a bundle of thin glass plates or by a Nicol's prism. 3. Is there any other method to produce the achromatic effect in lenses than by combining flint and plate glass lenses? A. The outstanding aberrations of a combination such as a microscopic objective are corrected by the opposite aberrations of the back lens and of the eyepiece. 4. What is a good work on optics? A. Silliman's "Physics," though not very recent, contains the best optical formulæ for achromatism. Atkinson's "Ganot" is atrociously deficient in this respect.

(7) A. S. asks: If a cistern is 11 feet in diameter and 9 feet deep, how many gallons will be its contents? A. Multiply the square of the diameter by 5·875 times the hight, to find the contents in U. S. gallons.

(8) J. B. C. says: I have, for this last 25 years, on every Saturday evening turned the inner side of my engine belt outside, let the engine run slow, and washed the belt well with warm water and soda, applied with cotton waste. Next, I take a piece of sheet metal and scrape well the belt, next wash with clean warm water, and dry off. I collect the waste oil from the shafting, and apply to the belt as much of it as possible. The washing must be done as quickly as possible so as not to dissolve the glued parts. I let the belt stand on the pulleys till Monday, then give another scraping and turn the belt as before. I keep the pulleys very clean. I have long been surprised at the economy I have effected, with very little trouble. I have not bought a new belt for the last ten years. There is an engine next me, 14x36 inches (mine is 12x36). I have nearly double the shafting and belts, and my neighbor cannot run with less than 38 lbs. of steam when all the belts are on the loose pulleys. Mine will run at full speed with 5 lbs. A. These suggestions will be appreciated by our readers. One must begin with a first class belt, made in the best manner, and use considerable judgment, in following the practice of our correspondent.

(9) D. L. C. asks: What causes the diurnal motion of the earth? A. The vortical movement of nebulæ, cyclones, and eddies is produced by streams of particles meeting from nearly opposite directions.

(10) F. W. M. asks: 1. Is $\frac{7}{8}$ lap on the slide valve ⅞ on one end, or is it ⅝ on one and $\frac{1}{16}$ at the other? A. On one end. 2. What is meant by the longitudinal and curvilinear seams of steam boilers? A. Longitudinal, in the direction of the length; curvilinear, around the shell. 3. Does the crank of a steam engine move six times as far while the piston is making the first inch of the stroke, as it does while it is making the middle inch, and a little over twice as far while it is making the second inch, and a trifle over 1½ times while it is making the third inch? If so, does the same variation apply to all engines regardless of length of crank? Is there any rule by which to find the distance the piston moves while the crank is describing a certain part of the circle? A. It depends upon the relative length of connecting rod and crank. You will find a table giving the desired information on p. 164, vol. 32. See also Auchincloss' treatise on "Link and Valve Motions."

(11) C. W. S. says: You state that the difference between high and low pressure is that in one the steam is condensed, in the other it is exhausted into the atmosphere. A claims that the one in which the steam is condensed is the high pressure. Is he right? A. No.

How far can sound be heard and words be understood through speaking tubes? A. Several hundred feet, so far as our experience goes.

(12) L. R. B. asks: 1. What power, as usually rated on steam engines, is required to drive a 17 inch surface planer on thin soft wood? A. From 5 to 6 horse. 2. What is needed to drive a 15 inch circular saw in 6 inches of soft wood? A. From 12 to 15. It is to be observed that these estimates are for driving the machines up to their capacity, so that the power required can be reduced considerably if less work is done by the machines. 3. What is commonly used to thin printer's ink? A. Soap is very often employed.

(13) T. McK. says: I have a small camera obscura with a double convex lens, and I find that it does not give a distinct picture of objects at unequal distances from the camera at the same time. For example, when an object 12 feet distant is distinctly shown, another 16 or 18 feet distant is indistinct, and *vice versa*. 1. What combination of lenses is necessary to produce a distinct picture of both objects at the same time? A. You should focus on the foreground, and put a cardboard stop a couple of inches in front of lens, diminishing its aperture. 2. What combination of lenses is used in photographing landscapes? Is there any difference between a landscape and portrait combination, and, if so, what is it? A. See answer No. 59, February 27, 1874.

(14) J. C. says: I have a cranberry patch of 2 acres. It is flooded with water early in November annually. The dam is made of swamp dirt, and (at the outlet) is 7 feet in width by 6 high. The water is 3 feet in depth at the place of drainage. For the past two seasons a box made of plank without bottom has been made for the water to pass through in summer, and this box closed with dirt in winter, and made in the most thorough manner; but the frost elevates the plank and the water breaks away underneath, and the vines are drained of water. The question is, is there any method of inserting anything, that it may hold water? A. It is difficult to prevent such action in very cold weather.

(15) E. E. W. asks: 1. How can I, having a lens of 16·7 inches radius on one side, calculate the radius for the other side, to make a lens of any required focal length? A. To find the principal focus of double convex lenses whose refractive index is 1·5: Divide twice the product of the radii by their sum. Quotient=focus for parallel rays. 2. How can I make it a double convex of 11·5 inches focal length? A. Second surface, 9 inches radius of curvature.

(16) J. S. asks: What width of flat belt will convey the same power as a ¾ round belt running in properly grooved pulleys? A. About 2 inches.

What will be the centrifugal force in lbs. of ten iron balls weighing 1 lb. each attached to a wheel two feet in diameter and running at a velocity of 3,000 revolutions per minute? A. The centrifugal force in lbs. is found by multiplying the weight of the body in pounds by the square of the number of revolutions per minute, and by the radius of the wheel in feet, and dividing the product by 2,935.

(17) D. W. asks: What is meant by horse power of engines? A. Horse power is a technical term for a unit of work, in a minute, equivalent to 33,000 foot pounds in that time.

(18) M. R. asks: Does a crank pin turn on its axis when an engine is at work? A. No.

How is beeswax bleached? A. There are several processes: exposure to the air, treatment with chemicals, treatment with steam. See p. 299, vol. 30.

How can I tan sheep skins when they are very dry and old? A. See p. 233, vol. 26.

(19) F. G. P. says: You said in a late issue that the cylinders of the Great Eastern were 14 feet long. Will you please tell me if they were oscillating? A. Yes.

(20) G. S. C. says: If C. B. F. will take the precaution to moisten the contents of the porous cups with the sal ammoniac solution while packing the carbons, he will be able to obtain a current as soon as the circuit is closed. I have two similar cells in which the peroxide of manganese used was in a fine powder, and the coke was likewise in powder, but a little coarser.

(21) W. E. H. asks: What work on electricity is the best in all its details? A. De la Rive's works are probably the most comprehensive upon the subject.

(22) T. M. Jr., F. P. L., J. A. T., and others.—The phenomenon you observed was unusually beautiful. Parhelia and bands of light passing through the sun are attributed to reflection from ice prisms which float, up to an inch in diameter, in summer air currents, above ½ mile high. Any change in the temperature and density of the air alters the path of the rays and inverts or distorts images like a speculum polished while unequally warm.

(23) W. A. S. asks: How shall I wash nickel, precipitated in nitric acid, by adding cyanide of potassium? A. In water. 2. How shall I insulate a copper wire above the junction with the copper plate in the bottom of a Callaud battery cell? A. With gutta percha. 3. What materials are used in making silver and gold solutions for plating with? A. See No. 26, p. 218, vol. 32.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Kaolin. By J. T. A. H., by W. C. K., and by N. W. B.

On the Number Seven. By J. D. L.

On a Boiler Explosion. By H. W. G.

Also enquiries and answers from the following.

W. H.—S. C. H.—A. J. K.—L. M. W.—F. N.—J. T. O.—F. P. B.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who makes hydraulic motors for sewing machines? Who makes springs for propelling street cars? Who sells the best emery for grinding glass? Who sells artificial stone? Who sells iron work for aquariums? Who sells mangles? Who publishes a paper printed in phonography?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,213, 8,214.—CASTS.—J. W. Fiske, New York city.
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8,218, 8,219.—CARPETS.—A. Redfern, Philadelphia, Pa.
8,220.—SALT CELLARS.—J. S. Atterbury, *et al.*, Pittsburgh, Pa.
8,221.—DISHES.—S. B. Close, New York city.
8,222.—CALL BELLS.—H. S. Kerr, Philadelphia, Pa.
8,223.—WALL BRACKET.—H. Peacock, Philadelphia, Pa.
8,224.—STOVE PLATES.—G. Smith *et al.*, Philadelphia, Pa.
8,225, 8,226.—ENVELOPES.—R. Sneider, Brooklyn, N. Y.
8,227.—BOTTLE.—F. Storm, Philadelphia, Pa.
8,228.—SHIRT BORDER.—C. S. Vetter, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,302 to 2,304.—PLOWS.—Avery & Sons, Louisville. Ky.
2,305.—HAMS, ETC.—Evans Bros., Cincinnati, Ohio.
2,306.—SPRINGS, ETC.—Spring and Axle Works, Fort Plain, N. Y.
2,307, 2,308.—FIRE BRICKS.—Harrison *et al.*, Pittsburgh, Pa.
2,309.—BAKE POWDER.—Jewett & Co., Milwaukee, Wis.
2,310.—TOBACCO.—Pioneer Co., Brooklyn, N. Y.
2,311.—WOOLENS, ETC.—Washington Mills, Lawrence, Mass.
2,312.—PLOWS.—B. F. Avery & Sons, Louisville, Ky.
2,313.—DENTIFRICES.—C. Bullock, Cambridge, Mass.
2,314.—LARD, ETC.—Chesebrough *et al.*, Philadelphia, Pa.
2,315.—PAPER.—Keith Paper Co., Turner's Falls, Mass.
2,316.—CIGARS.—Kerbs & Spiess, New York city.
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CANADIAN PATENTS.

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4,513.—L. Heath, Boston, Mass., U. S. Shoe. March 19, 1875.
4,514.—T. B. Coursey, Spring Mills, Del., U. S. Turbine water wheel. March 19, 1875.
4,515.—W. C. North, Cleveland, Ohio, U. S. Ventilating faucet. March 20, 1875.
4,516.—J. Blow, Bowmanville, Ont. Fire kindler. March 20, 1875.
4,517.—W. Walker, Montreal, P. Q. Tubular lantern. March 20, 1875.
4,518.—B. P. Aylsworth, Picton, Ont. Buggy body. March 20, 1875.
4,519.—B. F. Sturtevant, Boston, Mass., U. S. Compressing boot peg ribbon. March 20, 1875.
4,520.—B. F. Sturtevant, Boston, Mass., U. S. Fastening for boots. March 20, 1875.
4,521.—J. L. Kerr, Allegheny, Pa., U. S. Gun. March 20, 1875.
4,522.—O. Jenness, Alton, N. H., U. S. Vehicle spring. March 20, 1875.
4,523.—T. Linklater, Belleville, Ont. Eaves trough. March 20, 1875.
4,524.—C. W. Volney, Brockville, Ont. Explosive powder. March 20, 1875.
4,525.—G. Seger *et al.*, Humberstone, Ont. Force pump. March 22, 1875.
4,526.—E. C. Ibbotson, Chelsea, Mass., U. S. Railway joint. March 22, 1875.
4,527.—D. L. Toppan, Somerville, Mass., U. S., *et al.* Wood planing machine. March 22, 1875.
4,528.—E. Cliff, Pickering, Ont. Rein holder. March 22, 1875.
4,529.—J. N. Edy, Brantford, Ont. Motive power. March 22, 1875.
4,530.—A. Cant, Galt, Ont. Wood planing machine. March 23, 1875.
4,531.—A. A. Pope, Boston, Mass., U. S. Air gun and pistol. March 23, 1875.
4,532.—D. Allard, St. Albans, Vt., U. S. Smoke stack. March 23, 1875.
4,533.—J. McElroy, Arkona, Ont. Table-leaf support. March 23, 1875.
534.—M. Bird, London, England. Waterproofing leather. March 23, 1875.
4,535.—G. S. Walker, Erie, Pa., U. S. Clothes wringer. March 23, 1875.

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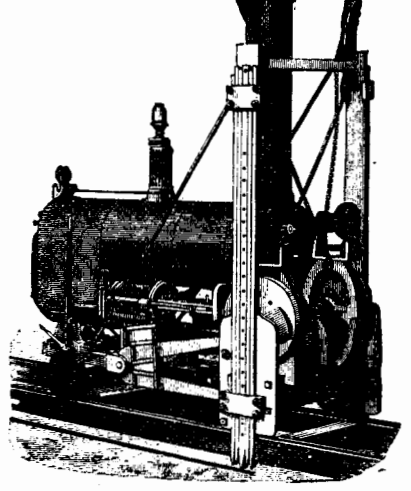

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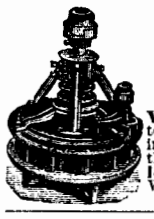

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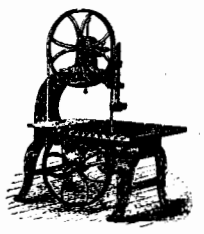

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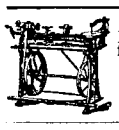

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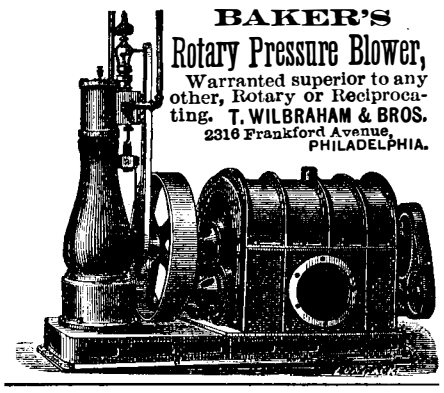

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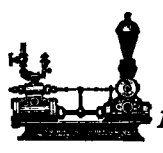
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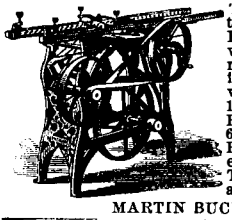

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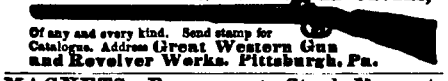
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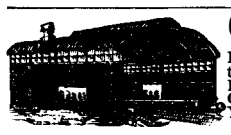

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